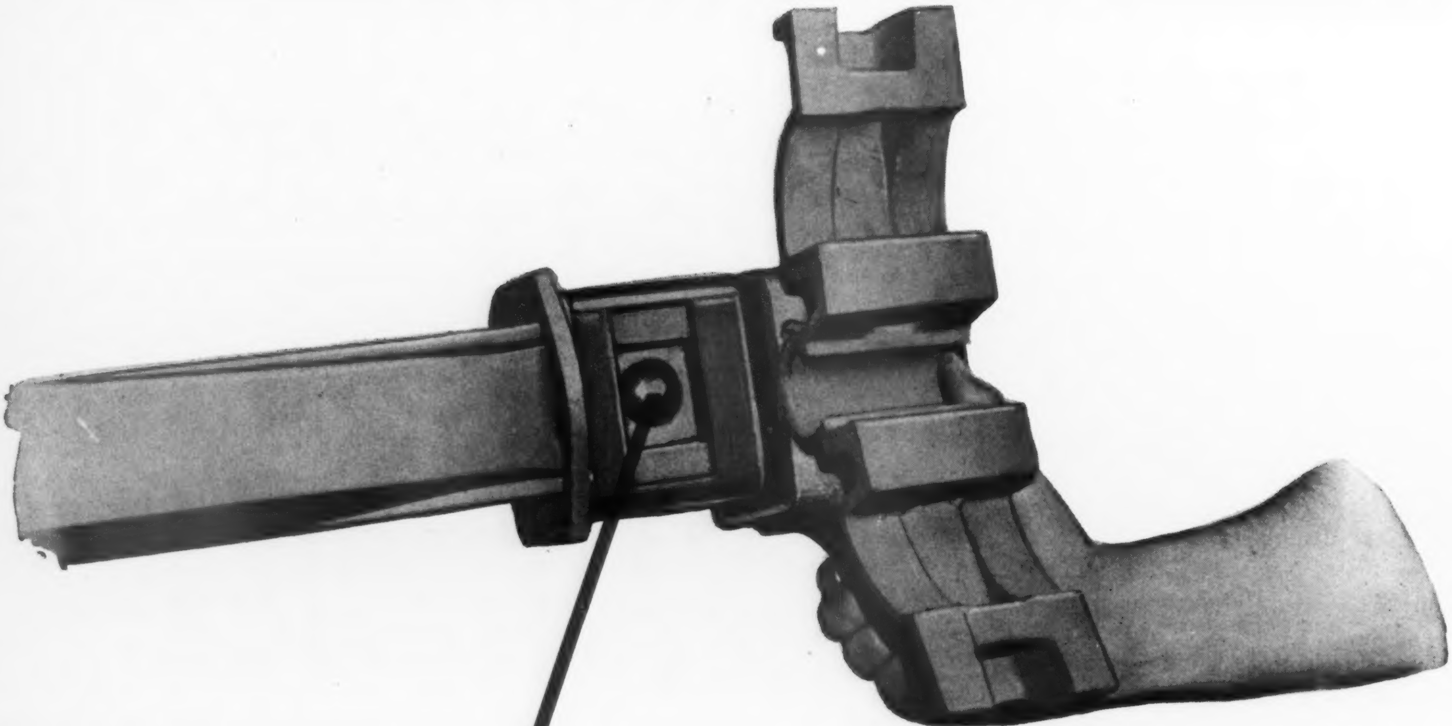
NOVEMBER, 1951

RAILWAY Mechanical and Electrical Engineer



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Impressions from the Coordinated Meetings

Greater Responsibilities

When an organization continues to grow year after year as the Locomotive Maintenance Officers' Association has there must be a reason; you can't charge it all off to the enthusiasm of its officers or to the persistent effort of its membership committee. Since 1939 this group has grown steadily from less than a hundred "old faithful" members to over 3,000. It has reflected the recognition on the part of hundreds of mechanical-department men of the need for an agency through the medium of which the knowledge of the technique in maintaining a new type of locomotive could be disseminated to thousands of departmental employees as rapidly as possible. It has served this purpose well and its success has been deserved.

Its very size, though, should be a warning. Things that are built rapidly and built big sometimes become top heavy. There are signs that the L.M.O.A. should reappraise its functions and reexplore its responsibilities to the industry. For the past five or six years the organization has done a good job of developing reports that have inspired, even incited, discussion on a variety of diesel power problems that definitely needed talking about. There are now broader problems that need to be approached with caution and understanding. Two of these are the questions of personnel training and the broad question of the design of diesel maintenance facilities. If some organization with the influence of L.M.O.A. doesn't soon lead the way in the matter of the relation of the younger employees to the railroads that employ them, whether it be apprentices, mechanics or the younger supervisors, it may not be long before the roads won't have any personnel training problem; the labor organizations may take care of it for them. The personnel committee could do a real job in 1952 and 1953 if they have the understanding to approach this subject with broadness of mind and the courage to attack it honestly.

As to diesel maintenance facilities, F. K. Mitchell's paper "We Pause To Plan," which appeared in the October issue, points out the real job that the L.M.O.A. should do—namely, set up a shop engineering committee that will consider this subject from a comprehensive engineering standpoint instead of dealing with it from the bolt-and-nut standpoint. There isn't a subject that the railroad industry needs information on today any more than on the matter of intelligent planning for future servicing and repair facilities, nor is there one that is liable to involve the possibilities for greater losses by way of exorbitant maintenance costs if the planning isn't intelligently done.

C.D.O.A. Meeting

The Car Department Officers Association now boasts well over 1,000 members and it is encouraging to note what a large proportion of the membership from all parts of the country were in attendance. At several of the sessions standing room only was available around the walls of a room seating about 400.

In a program of outstanding committee reports, it is difficult and somewhat hazardous to select any for special comment, but probably little exception will be taken to the following general statements: The report on wheel shop practices was comprehensive, authoritative and of real value to any railroad interested in building a new wheel shop or improving present wheel shop operations. The report on car lubrication was an intensely practical statement of causes and remedies for current hot-box difficulties; the discussion suggested that some of the major causes are beyond the control of car men.

The report on conditioning freight cars for higher commodity classification was notable for the amount of information included about what must be done to improve the condition of various classes of freight cars. The report in its entirety is a text book for car department apprentices and new employees in basic freight-car requirements.

The report on painting presented to this association for the first time essential information regarding how passenger car cleaning and painting materials are tested to determine essential requirements for best results. The discussion of this report was extensive, controversial in spots, generally pertinent and will add materially to the value of the association's year book.

Looking to the Future

With steam locomotives being rapidly replaced as the work horse of the railroads the Master Boiler Makers' Association is meeting the situation by turning to diesel locomotive work in which the boiler makers' experience can be utilized to advantage by the railroads. The Association is focusing its attention on the steam generators and the fuel and water tanks.

A number of the association's members have general supervision of welding as well as boiler work. This combination of duties is a natural one because the development of railroad welding has been associated closely with boiler fabrication and maintenance. The association will devote more of its program in the future to welding and it is contemplating presenting recommendations on the welding of diesel parts at its annual meeting next year.

The major interest in this year's annual meeting reports was shown in the one on the washing and testing of steam generators. Next year some definite recommendations on this work will be presented with the emphasis placed on the elimination of coil failures. The water-supply tanks will also receive attention, particularly with respect to design changes that will facilitate inspection and washing.

Steam locomotives were not neglected. One report dealt with the current replacement of riveted boiler shells by welded shells. Another covered the savings that can be obtained by the use of anti-foaming compounds which permit carrying a higher percentage of solids.

The Master Boiler Makers' Association will celebrate its "Golden Aniversary" next year and is looking forward to continuing to serve the railroads as faithfully and by "pulling no punches" as it has since it was founded in 1902.

Growing Pains

Discussions of Electrical Section reports disclosed a membership which was greatly concerned about a difficult and growing situation and which is making an earnest effort to get it under control.

It was stated, for example, that air conditioning of passenger cars doubled electrical maintenance requirements, while the advent of the diesel locomotive has increased it many times. In the locomotive field this has created a need for electricians which apparently cannot be met by hiring them from the outside. There are few available who have had any railroad experience, and outside industry, with the increasing demand for defense, is willing to pay rates which are higher than those paid by the railroads. The net result is an enormous demand for training and education. It has become necessary to give special training to men who have no electrical background and whose jobs may be in jeopardy because of the decline of the steam locomotive.

In the car department increased duties have gone beyond the capacity of existing forces. It frequently becomes necessary to let a piece of equipment which is due for inspection go over to the next trip with the hope and, perhaps, a prayer that it will get by. It appeared to be the concensus of opinion that cars with failed equipment be held out of service, that work done be followed up by close inspection, that equipment performance records be improved, and that more young men be brought into the service and given special training.

Diesels and Air Brakes

The changeover to diesel power has not occurred without affecting even the air-brake man. New problems for him to solve have arisen both in regard to learning to operate and maintain the brake equipment installed on diesel power and in deciding which of two general types to apply on what types of locomotives. The latter was one of the "hot" subjects of this year's Air Brake Association meeting.

There is no great difference of opinion on whether to apply 24-RL equipment or one of the No. 6 equipments if the locomotive in question has a clear cut assignment. Road locomotives get the former and switchers get the latter. But what of the road switcher? What determines whether the added cost of the 24-RL can be justified? Is it a question of the portion of time the locomotive spends in road service as compared to that spent switching? Or is it a question of the type of road assignments made, high speed or drag? How about other traffic operating on the same stretch of rail, and what about the run itself? What about the improved No. 6 type arrangement described in one of the papers? Will such modifications make the cheaper and simpler-to-maintain No. 6 suitable where it would otherwise be questionable? If 24-RL is applied extensively in place of No. 6, where will we get the additional men to inspect and maintain it, requiring, as it does, several times as long as the No. 6?

Not all these questions were, or could, of course, be given a final answer. But no one who attended the 1951 Air Brake Association meeting could have come away without having his thinking stimulated and his outlook broadened.

Joint Sessions

One of the advantages of holding simultaneous meetings of the six Coordinated Associations in the same place is the opportunity it affords for two associations to get together in joint sessions for discussions of subjects which are of mutual interest. Two such sessions were held during the meetings at Chicago in September. In one the Air Brake Association joined the Railway Fuel and Traveling Engineers' Association in the discussion of a report on train handling. In the other, the Electrical Sections joined with the Locomotive Maintenance Officers' in the discussion of the Electrical Section report on Automotive and Electric Rolling Stock and of Fay Thomas' paper on wheel slip on diesel-electric locomotives. Each session was confined to one hour.

There are sufficient elements of controversy in the subject of train handling so that, once the discussion is started, the problem is not to keep it going, but to bring it to an effective conclusion. The joint Air-Brake-Traveling Engineers' session over ran its time by more than half an hour and it was too late to permit the Air Brake Association to resume its own program.

Following completion of the program of the joint Electrical Section-Locomotive Maintenance Officers' session the Electrical Section adjourned and the Locomotive Maintenance Officers continued with its own program, on which was a report on cleaning and testing diesel-electric motors and generators. Certainly this is a subject of great interest to many members of the Electrical Section, and one the discussion of which would have benefitted by their participation. The usefulness of joint sessions probably can best be realized if all reports for them are the work of carefully selected joint committees and if each program covers an entire half-day session.

Air Brake Men Discuss a Wide Variety of Problems

The outstanding themes at the air brake meetings were the development of information for the 24-RL equipment and the maintenance of freight car brakes

F. C. Wenk
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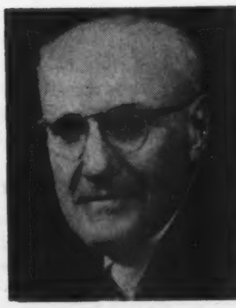


L. Wilcox
Secretary-Treasurer

THE Air Brake Association held its 43rd annual meeting—and its fifth as a member of the Coordinated Railroad Mechanical Associations—at the Hotel Sherman in Chicago from September 17 through 19. The meeting was presided over by K. E. Carey, first vice-president, in the absence of President Fred C. Wenk, who was unable to attend due to illness.

Prominent among the subjects dealt with was the inspection and maintenance of all diesel locomotive brake equipment, and possible modifications of switching locomotive brake equipments to render them suitable certain road services. Two papers covered 24-RL locomotive brake equipment, and one described the No. 6 switcher brake equipment and outlined some features that could be added to it to permit limited use on road switchers. At several times there were lively and informative discussions as to whether road switchers should be equipped with the modified No. 6 equipment or whether 24-RL should be installed despite its greater cost.

Freight and passenger brake problems received a full share of attention. A detailed study of the effect of air leakage on the former, and one of the maintenance of clasp brakes on the latter were presented and discussed on the second day.

The convention attendees also heard a progress report by a committee set up by the Air Brake Association to gather information on standardizing the location and application of diesel brake equipment.

Repairs were dealt with extensively, both in papers devoted exclusively to maintenance and as parts of other papers. Attention was called to the fact that more, not fewer, men are needed for proper maintenance of air brakes, and for the allied function of inspection, if we expect to continue to run long trains. More men were felt to be needed if the current tendency to add new features and complications to brake equipment continues.

Several members at times expressed the thought that certain pieces of information presented at the convention would do the maximum amount of good only if these could be made known to the car man and if he could be sold on the merits. It was said that there are plenty of rules and regulations, including those of the A.A.R. The problem is to get compliance.

24-RL Locomotive Brake Equipment Troubles and Remedies

It has previously been stated that it is not good practice to make repairs or adjustments to air brake devices while on a locomotive because of the possibility of dirt entering the valve parts. The repair of portions should be made in the Air Brake Room whenever possible for cleanliness and for later testing to insure that they will function properly when applied to the locomotive. It has been found advisable to have cleaned and tested portions readily available as replacement.

Before attempting to locate any trouble, check the points listed below:

1. Electric brake switch in "ON" position.
2. Motor generator set, if used, operating properly.
3. Battery voltage within the tolerable limits.
4. Jumper cable between units connected and in serviceable condition.
5. Position of hand brake (applied or released).
6. Auxiliary reservoir and main reservoir pressure up to standard and air compressors operating poperly.
7. Accuracy of air gages.

After the above points have been checked, the outline that follows will assist in locating and remedying trouble.

I. With the electro-pneumatic brake applied to full or any intermediate pressure, a wide fluctuation of the straight air pipe pressure may be caused by one of the following reasons:
   - A. Self-lapping portion of the automatic brake valve defective.
     1. High packing cup friction causing the binding and erratic opening and closing of the discharge valve.
     2. Lack of lubrication causing excessively high friction between moving parts of self-lapping unit.
     3. Leakage of the inlet or discharge valves.
     4. Defective or broken piston spring: *Remedy—Replace self-lapping portion.*
   - B. Master Controller defective because of:
     1. Improper adjustment of contacts.
     2. Corroded or worn contacts.
     3. Straight air pipe or control diaphragm ruptured.
     4. Leakage past check valve causing overcasting.
     5. Restricted choke allowing overcasting of master controller: *Remedy—Replace master controller.*

II. With the electro-pneumatic brake applied to full or any intermediate pressure, excessive pumping of the master controller may be caused by:
   - A. Straight air pipe leakage.
   - B. Excessive range in self-lapping unit of automatic brake valve together with control pipe leakage.
   - C. Improper gap between contacts of master controller.
   - D. Leakage at exhaust of 21-B magnet will result in drop in straight air pipe pressure: *Remedy—Replace 21-B magnet.*
   - E. Interruption of current to 21-B release magnet which will cause drop in straight air pipe pressure: *Remedy—Repair fault in circuit.*

III. Excessive arcing of master controller contacts may be caused by:
   - A. Defective arc suppressing condensers of master controller.
   - B. Excessive current demand for electric brake circuits resulting from:
     1. Shorted 21-B magnet coils.
     2. Shorts in train line wiring.
     3. Too many cars in train. *Remedy—Eliminate shorts in electric brake circuits or reduce length of train.*

IV. Incorrect electric brake operation may be due to 2-B magnets being defective for one or more of the following reasons:
   - A. Leakage at 21-B magnet exhaust port when brakes are applied due to:
     1. No current to exhaust magnet of 21-B resulting in exhaust valve not closing.
     2. Shorted or burned-out exhaust magnet coil.
     3. Worn or leaking exhaust valve seat.
     4. 21-B magnet pipe bracket gasket leakage.
     5. Broken or missing exhaust magnet armature stem.
     6. Exhaust magnet armature stem stuck in release position.
   - B. Leakage at 21-B magnet when brakes are released due to:
     1. Worn or leaking application valve seat.
     2. Application magnet armature stem stuck in applied position.
     3. Pipe bracket gasket leakage.
   - C. Failure of straight air pipe pressure to build up when electro-pneumatic application is made may be due to:
     1. No current to application magnet of 21-B magnet.
     2. Application magnet coil of 21-B magnet burned out or shorted.
     3. Broken or missing 21-B application magnet stem.
     4. 21-B application magnet armature stem stuck in release application.
     5. Protective valve of 21-B magnet closed because of either low auxiliary reservoir pressure or defective protection valve.
     6. Clogged or restricted strainer or pipe bracket choke of 21-B magnet.
   - D. Failure of brakes to release after electro-pneumatic application may be due to:
     1. Release magnet valve of 21-B magnet stuck closed when straight air pipe cutout cocks ar closed. *Remedy—Open straight air pipe cutout cocks between units and replace 21-B magnet.*
     2. Circuit to release magnet of 21-B not broken because of:
        - a. Grounds between release wire and B+ wire of other equipment.
        - b. Failure of master controller release contact to open.
     3. Hand brake not released.
     4. Automatic brake set.
     5. Incorrect reading on brake cylinder gage.

V. Improper, or failure to build up, brake cylinder pressure during an electro-pneumatic application may be caused by:
   - A. Excessive straight air pipe, cutout cock, hose or gasket leakage.
   - B. S-40-D Type independent brake valve handle in lock-down position rather than release position.
   - C. D-24 control valve, independent application and release portion not operating properly due to check valve leakage.
   - D. Brake cylinder gage defective.
   - E. Straight air pipe pressure fails to build up. *Remedy—Check operation of 21-B magnets, master controller and check for straight air pipe leakage.*
   - F. Excessive brake cylinder leakage.
   - G. Brake cylinder cutout cock closed.

Speed Governor Operating Tests

The speed governor control used in conjunction with the electro-pneumatic brake consists of an axle generator, relay panel and an FS-1864 relay valve including a magnet portion and K-3 switch portion. Failure of the speed governor equipment to operate properly may be due to one or more of the following:

I. Panel light fails to burn at proper time caused by either a burned-out light or the directional relays in relay panel being inoperative.

II. The speed governor equipment may not cause the brake cylinder pressure to increase or decrease in accordance with speed due to:

A. Repeater relays fail to respond because of burned-out coils or corroded contacts.

B. Wiring from axle generator to relay panel defective.

C. Generator voltage output not in accordance with standard for various axle speeds.

D. Improper adjustment of high, medium and low speed relay resistors in relay panel.

E. Magnet portion of FS-1864 relay valve fails to respond to relay operation because of:

1. Ruptured diaphragm in relay portion.
2. Broken or stuck high, medium or low speed manet coil armature stem.
3. High, medium or low speed blowdown chokes restricted.
4. Magnets fail to respond when speed governor panel relays operate due to:
   a. Battery switch being cut out.
   b. K-3 switch fails to close power circuit to magnets.
   c. Wiring from relay panel to magnets defective.
   d. Incorrect voltage coil use in relay valve magnets.

The report was a presentation of a committee of the St. Louis Air Brake Club, of which E. W. Erisman of the Wabash is chairman.

Discussion

Considerable differences of opinion were expressed regarding where and by whom the master controller may be adjusted. One road operated electro-pneumatic brakes successfully for five years without even having a test panel. Others said that it deserves the best of maintenance and test equipment. As to adjusting the master controller, one road did not allow it to be fixed in place as it was felt that engine crews would eventually be tampering with it. Another road does not permit engine crews to touch it, but has competent mechanics adjust it in place, and thinks that if a mechanic cannot do this job in place he needs education.

Improved No. 6 Type Brake Equipment for Diesel Switching Locomotives

The major changes in the latest No. 6 type equipments as compared to the 14-EL include the substitution of a self-lapping type independent brake valve for the previous manual lapping type, addition of a sander operating valve, and a bell ringer valve to the brake valve assembly, and a more compact grouping of the cab devices to eliminate much of the exposed air brake piping. Experience with self-lapping type of brake valves on other types of locomotives and in other uses indicated that the independent brake function for switching purposes would be improved by its use. The self-lapping brake valve does not require a manual movement of the handle to lap position after a movement to a brake applying position. The position of the handle through its range of movement determines the degree of brake application. As the self-lapping brake valve embodies the pressure regulating means, previously provided by a reducing valve, the latter device is not required with any of these No. 6 type equipments.

The extension of the diesel switcher into branch line and transfer service, and the development of the road switcher or general purpose locomotive, has resulted in adding certain features to the air brake equipment. The most significant of these are the provision for multiple-unit operation, and the incorporation of such safety features as service safety control, overspeed protection, and automatic train stop, features formerly associated with modern road locomotive equipments. These additions were made, not to make the No. 6 equipments suitable for road service, but to enhance the safety and broaden the scope of the locomotive in general yard switching service.

Until very recently, multiple-unit control in these equipments has been obtained by the addition of a filling piece and transfer valve located between the reservoir and operating portion of the standard 6-KR distributing valve, thus converting the latter to the well-known 6-DKR type. The transfer valve is not a new device, as it was included in the original 14-EL equipment on many electric locomotives. As used with the 6-DKR assembly, it relays the performance of both the automatic and independent brake systems from the leading unit to the trailing unit through a connecting pipe line designated as the "Equalizing Pipe." The transfer valve is positioned pneumatically on the lead unit to charge the equalizing pipe from the brake cylinder, and on the trailing unit to connect the equalizing pipe to the application portion of its distributing valve, thereby duplicating changes of brake cylinder pressure on the lead unit in the brake cylinders of the trailing unit. The positioning of the transfer valve is controlled by the proper positioning of the three-position double-heading cock of 14-EL, 6-BL and 6-SL equipment, and by a separate cock located in the transfer valve operating pipe of 6-DS equipment when multiple-unit control only is involved. Because of the extended length of the double unit locomotive, brake pipe vent valves are required to insure propagation of emergency brake action both to and from the train.

Addition of special control apparatus to the basic automatic brake systems of the 14-EL and No. 6 type brake equipment for the purpose of obtaining safety control, overspeed control, and train stop brake applications, has presented a rather awkward problem which has been inadequately solved until the recent development of a new form of brake application valve known as the N-1-A. Heretofore, the requirements for these more elaborate controls have been relatively so infrequent on switchers, that it has been expedient to employ older brake application valves such as the B-2, B-3 and F types, all of which are limited to producing an emergency brake application. The N-1-A produces a service brake application, and consists of a single pipe bracket to which are mounted the service application portion, the equalizing piston valve portion, the safety control relayair portion, the brake pipe cutoff valve portion, and the double heading cock. Inclusion of all these portions in a single valve unit reduces the number of individual pipes to a minimum.

For the purpose of overspeed control or train stop type of train control, an electro-pneumatic valve is connected to the No. 10 pipe of the N-1-A brake application valve, and for safety control including the suppression feature, a foot operated valve is connected to the No. 12 pipe. Exhaust of air pressure normally confined in these pipes, either through the foot valve or through the electro-pneumatic valve, causes the application valve portion to assume its applied position. Since this latter portion must function automatically to reduce equalizing reservoir pressure at a service rate when it moves to applied position, the equalizing piston valve must be located where it can be operated by both this valve and the automatic brake valve. This is accomplished by moving the equalizing piston valve function from the brake valve to the N-1-A brake application valve. Thus, the automatic brake valve portion, so arranged, is designated the type "X." It includes a rotary valve having a "lock-over" port which prevents the return of the brake application valve portion to its normal release position until after the brake valve handle has been moved to Lap position. Also, the equalizing piston has been removed from it and a properly ported blanking plate applied between the rotary valve seat and equalizing piston valve portions. The "X" type

automatic brake valve portions are not interchangeable as units with those used on steam locomotives or diesel switchers on which the special automatic features provided by the N-1-A valve are not involved. Also, with this special equipment an emergency relay valve is required to insure obtaining a brake valve initiated emergency brake application regardless of the position of either the application and brake pipe cutoff portions of the N-1-A valve or of the pipe cutout cock.

When the many features of the N-1-A brake application valve and related devices are added to those of multiple-unit control, it is readily apparent that the service expected from locomotives so equipped can demand far more in brake apparatus than was ever contemplated in the simple automatic and independent brake systems of the original smaller yard switchers. It is not surprising, therefore, that a demand has been created for every possible simplification of the equipment and piping required for the varying intended services. This demand, together with recent requests for still additional provisions in the No. 6 type diesel switcher equipments for an adequate dynamic brake interlock and better protection against loss of air in the event of a break-in-two of connected locomotive units, has resulted in a modification of the 6-SL and 6-BL equipments which presumably will become the future standard wherever these types of equipments are employed.

[The remainder of this paper described in detail the following newer elements of these future standard arrangements: The No. 6-BL and No. 6-SL equipments arranged for multiple-unit operation with H-6-B relayair valve; the No. 6-BL and No. 6-SL equipments arranged for both multiple-unit operation and dynamic interlock with H-6-A relayair valve; and break-in-two protection as afforded by H-6-A and H-6-B relayair units. It also urged that 24-RL equipment be used on all diesels intended for road service. A motion was made during the discussion but defeated in a close vote, that this recommendation be stricken from the report. Those favoring this recommendation felt that the No. 6 equipment modified as described in the report would perform many services satisfactorily and it was a good deal cheaper than 24-RL.—Editor]

The report was a presentation of the Manhattan Air Brake Club.

The Maintenance and Testing of Decelostat Equipment

In yard testing, the decelostat equipment should be tested before each trip, but not less frequently than once each week, in accordance with the test codes using the test device. The car air brakes should be applied, and the test device should be applied to the decelostat as outlined in the preliminary instructions of Test Code T-1632-O. It is important that the decelostat be tested in each direction by rotating the dial housing slowly and noting that the leaf spring tension of the test device is sufficient to cause the decelostat equipment to operate.

If the test device is not available, a suitable test of the equipment can be made by removing the external exhaust plug and rotating the decelostat inertia wheel with the finger to cause the decelostat equipment to operate. It is important to rotate the inertia wheel in both directions to insure proper decelostat operation regardless of direction of car travel. In addition, the inertia wheel should be held in the tripped position a sufficient period of time to determine that the broken pipe feature is functioning. This may be determined by noting that the brakes reapply. This "finger test" will determine if the decelostat equipment is functioning, but not if it operates within the proper limit of deceleration rates as is shown by the test device.

If, during either of the above tests, proper functioning is not obtained on one axle, the decelostat on that axle should be replaced. If proper function is not obtained on either axle, the proper portion of the B-3 decelostat valve should be replaced. If the equipment does not function properly in cold weather, the vents should be checked for ice.

When a decelostat or decelostat valve is found to be defective, it should be removed and taken to the air brake room for the proper repairs and testing. Present practice recommends annual cleaning and testing of all decelostat equipment; however, tests are being conducted to determine if this period of time can be extended.

Shop Maintenance

When portions have been removed to the air brake room, dismantle in accordance with Instruction Leaflet 2612-1, of June 1949. After pilot valve body portions have been removed and before further dismantling, a visual inspection of all parts should be made to detect wear or excessive lost motion. At this time, the cam should be checked for wear, and, if any is visible, check to determine if it is within allowable limits as follows: .010 in. cam wear is considered the maximum allowable, and this wear can be measured at the pull rod, .010 in. cam wear being the equivalent of .005 in. travel of the pull rod. This travel can be measured by using gage No. 107237 and suitable feeler gages. The space between the gage and the pull rod is measured with the feelers when the cam roller is on the flat portion of the cam. The cam roller is then moved to the worn portion of the cam, and the clearance between pull rod and gage is again measured. The difference between these measurements should not exceed .005 in. The cam roller should be examined to ascertain whether it is equipped with steel bushings in the fulcrum pin holes. If it is not so equipped, or if there is any sign of wear in these holes, the lever should be scrapped and a new one substituted. It is important that the decelostat be completely disassembled so that all parts may be examined and checked.

All parts should be thoroughly cleaned as outlined in Instruction Leaflet 2612-1. The sealed ball bearings should not be cleaned in any solvent, as these bearings are lubricated for the life of the mechanism and any cleaning solvent would have a harmful effect. These bearings should be cleaned externally by wiping with a clean cloth, and blowing with an air jet. Bearings that are not sealed can be cleaned in a suitable solvent, blown dry with an air jet, and later repacked with an approved lubricant. The chamber should be completely filled by using a grease gun at the tapped hole after removing the plug. All bearings should be thoroughly checked by hand rotation to determine if there are any indications of wear or damage.

Lubrication and Assembly

Only approved lubricants should be used. The rubber seated check valves should be treated with triple valve dry graphite. The check valves should be placed in a box with dry graphite and shaken, then removed, and the excess graphite lightly wiped off on a piece of chamois. The threads of choke plugs and other removable plugs should be coated lightly with a compound consisting of one part graphite and two parts SAE-20 oil.

Parts of the decelostat that should not be re-used include the shaft lock washers, the fulcrum lock washers, diaphragm follower packing ring, and all lock wires. Several roads have had good results using a steel cotter pin in place of the annealed brass fulcrum lock wire, as the annealed brass wires have been known to shear off due to improper installation or other causes. Do not use a drift punch to position the fulcrum pin after the lock wire or cotter pin has been placed. This has been known to shear off the lock wire without being apparent to the workmen and resulting in subsequent failure of the decelostat.

The equipment should be assembled in strict accordance with Instruction Leaflet 2612-1. After assembly of the individual portion, the gages shown on Page 18 of the instruction pamphlet should be used. When gaging the decelostat housing portion, use Gage No. 107237. The correct pull rod height may be adjusted by the use of .010 in. shim. In some instances, the cam roller

shaft has been found to wear where it makes contact with the cam lever pull rod. Rather than scrapping the cam roller shaft, additional service can sometimes be obtained by rotating it 180 deg. so that an entirely new wearing surface is presented; this has, in some cases, eliminated the need for a shaft shim. When gaging the pilot valve portion, use gage 107238. Note that the pilot valve is in good condition and that the end is not flattened or peened over. This condition could result in improper operation even though the portion can be made to pass the gage. If the pilot valve tip is peened over, the valve may hang up at some time during operation and remain in the open position due to binding in the pilot valve seat in the open position.

The decelostat may then be removed to the test rack for necessary testing.

The B-3 decelostat valves should be dismantled, cleaned and assembled according to instructions in Instruction Leaflet 2612-1. Follow the same general method in cleaning and inspection and and lubrication as in the P-3. When reassembling, the diaphragm follower packing ring should be renewed.

The B-3 decolostat valve release portion should be tested on the AB test rack using Test Code T-1583-O, and the AB-88 test plate combination. The protection valve portion should be tested on the AB test rack using Test Specification T-1585-O, and the AB-85 test plate combination. The P-3 decelostat pilot valve portion should be tested on the AB test rack using Test Specification T-1517-O, and the AB-92 test plate combination. When testing the complete P-3 decelostat, the equipment shown on Page 24 of Instruction Leaflet 2612-1 is necessary for a sensitivity test. A torque wrench with a range of 0-80 inch-ounces is required to determine if the decelostat operates within the proper force range. The torque wrench is applied to the drive shaft at the rear of the decelostat.

The report was prepared by the committee on approved maintenance practices, of which F. W. Dell, G.T.W., is chairman.

Discussion

The discussion centered chiefly about the possibility of lengthening the present 1-year internal between cleaning the decelostat. One speaker felt that one year was long enough based on conditions found today at this annual cleaning; a second felt that while there are a number of improvements that have been made, a year is enough right now, but he hopes to increase this period so that it will coincide with the cleaning period of the brakes. A third is approaching the time when his decelostats will all go 24 months; the mechanical decelostats on his road are pretty well beat up as they approach two year's service due to the pounding from the box even though they are rubber-mounted. He thinks that electric decelostats should go 24 months. It was advocated that the ball bearing in the housing should be at least a hand-pressed fit as the bearing turns in the housing, causing wear of the housing and giving excessive clearance. In reply to this, another member said that ball bearing manufacturers recommend that the outer races be allowed to creep slightly so that given vibration will not pound the parts at the same place all the time. At present there is from .0001-in. interference to .001-in. clearance, but you can have several thousandths clearance without hurting anything. If the housing does wear too much it can be bored and rebushed. A bushing is not included in the new equipment as it would increase the cost more than felt justified for the few times it would be required.

Standardization of Air Brake Equipment on Diesel-Electric Locomotives

The studies made by this committee on standardization of air brake devices on diesel- and turbo-electric locomotives included functions of brake parts, additions of desirable elements, and the proper application and location of parts. Recommendations made and approved by this association are then to be processed through the Brake and Brake Equipment Committee of the A.A.R. so that the present A.A.R. Committee on Diesel Standardization will have available for its deliberations with builders, concrete evidence of what the best air brake minds deem essential for diesel air brake equipment.

A canvass was made by each member of the committee of many roads now using diesels and an expression was received, based on experience had with 4,765 diesel switchers, 1,581 road switchers, 4,199 road freight units, 1,329 road passenger units and 582 electric locomotives. The entire range of available diesel air brake schedules are represented in the above numbers of units in general, satisfaction expressed with the schedules as received, it being indicated from the replies received that the brake schedule should be selected in accordance with the use to which the locomotive is to be put.

The majority of those canvassed recommended 6-BL or 6-SL equipment for switching and road switch service, and 24-RL for road freight and passenger service.

For the most part, it was indicated that considerable improvement should be made in the location of the various air brake parts. Parts are now all too frequently located so that adjustments are difficult to make, inspections are impossible and removal for maintenance purposes are difficult of accomplishment and definitely wastes valuable man hours. For example, in many instances, air compressors are so located as to make inspection, orifice test and removal extremely time wasting and difficult. Air gauges are too small. In other instances brake valve pipe brackets have been so located as to hinder removal of portions at periodic inspection times and make adjustments of valves contained thereon difficult. Cutout cocks at the rear of A units and at both ends of B units should be so located outside of the end sill that their positions can be easily checked.

At least two manufacturers have taken definite steps to render complete cooperation and make corrective designs which we feel will materially improve the situation.

It is clearly indicated to this committee that dissatisfaction is widespread due to inadequate radiation systems. This Association has at the last two conventions received through the Manhattan Air Brake Club two papers on this subject covering several years study and containing definite recommendations for proper and adequate radiation.

In addition to such items, replies received by the committee specifically state that cab arrangements are in many instances subject to improvement. For example: Rotary valves should be so located near the control station so that they cannot be used as a footrest, but that the position of the operating handle can be checked from the engineman's normal position. It would materially improve the condition if the four positions of the Rotary valve were plainly marked with not less than ⅜-in. raised letters on the escutcheon plate.

The foregoing represents a brief resume of the committee's efforts to date and by no means exhausts the possibilities of further investigation.

The following items are recommended for transmittal to the A.A.R. Brake and Brake Equipment Committee for further handling with the A.A.R. Committee on Locomotive Construction, and in the judgment of this committee should be required from all builders:

1. Radiation systems to be in accordance with data contained in the proceedings of the 41st and 42nd Annual Convention of the Air Brake Association, and so arranged to obtain maximum benefit of available cooling effect.
2. Diesel switching and road switching units are to be equipped with 6-BL or 6-SL brake equipment except where road switch units are regularly used in multiple for road service; then it is felt such units should have 24-RL brake equipment.
3. Road freight and passenger units should have 24-RL brake equipment.
4. All parts of any schedule of brake equipment shall be so

located that required inspections and maintenance procedures can be made without undue waste of effort and time.

The report was submitted by a committee of which C. E. Miller, New York Central, is chairman.

Discussion

Because it takes longer to work No. 6 equipments as special features are added, and about three times as long to work 24-RL equipment as 6 ET, the practice of adding extras should be stopped until more men are furnished to maintain them. The need for the P.C. switch was questioned as it is not used on electric locomotives; the engineer has to close off the throttle himself after applying the brakes.

There was some controversy as to whether 24-RL equipment should be restricted to road locomotives only or should also be used on road switchers and those switching locomotives used occasionally in multiple with 24-RL equipped with locomotives. One example given was a GP-7 which might have to take the place of a B unit in an A-B-A combination. Under such conditions the GP-7 should have 24-RL equipment, whereas if it were only used singly the extra cost of $600 to $800 for 24-RL would not be justified. One member thought that the purpose of the standardization committee should be the proper location of the equipment and it should not concern itself with recommending any particular type of brake equipment for any service. A committee member replied that they had received such a wealth of good information from many lines that they merely summarized this thinking.

Effects of Air Leakage in Freight Trains

The study of the factors involved in the characteristics of the flow and leakage of air in air brake systems must be made under laboratory conditions for accuracy and consistency in the analysis of results. It is this use of stationary test racks representing the complete pneumatic air brake system of freight cars assembled in trains as long as 150 cars that accounts for apparent discrepancies between technical studies and the less accurate observations obtained on freight trains in actual service. Conditions on the two available freight train test racks of the air brake companies can be controlled so that all extraneous factors are eliminated or kept uniform. Measuring devices for pressure and air flow can be kept in accurate calibration and observations precisely coordinated in all parts of the train. It would therefore be expected that results on actual trains in service could be predicted from tests run under laboratory conditions; but that some discrepancies would be caused by factors which appear in actual service and which must be accepted as found. To understand what they are and how they affect brake performance is the first important step toward elimination of those which are seriously adverse.

The A.A.R. test for brake pipe leakage of a train, as determined during the outbound terminal tests, or if a single car as determined by the single car code of tests, requires that a brake application be made; and after the reduction has reached 15 p.s.i. from the original charged pressure, that the further fall in brake pipe pressure be observed for a period of one minute. This defines brake pipe leakage not in terms of the quantity of air lost to the atmosphere, but in terms (p.s.i. per min.) of the significant result of such loss. The actual amount of air (cu. ft. of free air per min.) leaking from the brake pipe will depend upon the number of cars in the train. If each car should uniformly have an amount of brake pipe leakage which would reduce the brake pipe pressure 3 p.s.i. during the first minute immediately after the 15 p.s.i. reduction has been completed, the leakage from the train brake pipe measured in this manner would be observed to be 3 p.s.i. per minute regardless of train length. In making this test the application has caused the feed grooves of all the triple valves to be closed and the loss of air is therefore measured from the brake pipe itself, including the branch pipes.

The care with which the A.A.R. brake pipe leakage test is made determines to a significant degree the validity of the result. It is easy to obtain a false reading by being in too much of a hurry. The standard instructions, which were written many years ago when long trains were the exception rather than the rule, do not specify the exact amount of initial charge (particularly on passenger trains) and do not define any time allowance for the brake pipe pressure to become equalized before the observation of pressure loss is started at the locomotive brake pipe gage. The practices of enginemen vary to a considerable extent. If the brake pipe leakage is relatively little, there may be a period after the equalizing discharge valve closes in which the brake pipe pressure remains steady or actually rises slightly. On the other hand, if the leakage is quite large, the quick service activity may continue at the rear end of the train during several seconds of the one minute timing interval. Both conditions will, of course, produce a false indication of actual pressure drop due to brake pipe leakage alone. It has been found by experience on train test racks that the best method is to make the initial equalizing reservoir reduction a few pounds less than 15 and to allow the brake pipe pressure to settle until the full 15 p.s.i. reduction is indicated on the air gage before the one minute timing is started. Much more consistent results will be obtained than by starting the timing immediately upon closure of the equalizing discharge valve at the 15 p.s.i. reduction level.

51 Points of Leakage

On a freight car there are a minimum of 51 points from which leakage can occur from the brake system when charged. Of these, 27 or more are in the brake pipe itself. This leaves 24 points of leakage (17 in the AB valve itself) which are included in what is known as brake system leakage, all of which may be on the reservoir side of the feed grooves. Any leakage that occurs at these 24 points is not taken into account by the brake pipe leakage test and, therefore, increases the air flow into the train only when the brakes are released and are charged.

On the average freight car equipped with AB brakes there is a total air volume in the charged brake system (exclusive of brake cylinder) of approximately 4 cu. ft. of which 0.5 cu. ft. is in the brake pipe. Nearly 1.5 cu ft. are in the auxiliary reservoir system and slightly over 2 cu. ft. are in the emergency reservoir system. The ratios of these volumes are approximately 1 for the brake pipe to 3 for the auxiliary reservoir to 4 for the emergency reservoir. On a terminal application test or single car test, leakage in cubic feet, of air lost from the auxiliary reservoir volume will not be easily found by the usual observations of brake action unless it is more than three times the brake pipe leakage. A brake will apply and remain applied over the intervals of time usually involved in such tests. If auxiliary reservoir leakage is greater than three times the brake pipe leakage in cubic feet of free air lost, auxiliary reservoir pressure will fall at a rate sufficiently rapid to cause the service portion of the AB valve to move to release position so that the brake will not remain applied. Leakage from the emergency reservoir system cannot be readily detected by observation of brake function during such tests. If it is so great as to interfere with charging, it may be detected by failure to obtain a charge within the 15-minute period under the single car code of tests. Generally, however, leakage from the auxiliary and emergency reservoir systems can be detected only by soap bubble tests or audibility of the larger leaks, such as cracked and broken pipes, loose pipe joints and fittings, etc.

When a train is fully charged, there exists what is known as a pressure gradient or brake pipe taper. This is the difference between the pressure in the brake pipe at the caboose and the pressure of the air delivered by the feed valve to the brake pipe. If there is a difference of 5 p.s.i., it is said that there is a 5-lb. taper in the train. If no leakage exists in the brake pipes or

reservoir systems of the cars, the pressure at both ends of the train will attain the same value and there will be zero taper. Under circumstances where there is leakage, there must, of course, be a continuous flow of air into the brake pipe to make up for that lost to the atmosphere. As this flow continues down through the train there is a gradual pressure loss due to friction through the pipes, angle cocks, and hose couplings. The greater the air flows, the higher will be the velocity and the greater will be the pressure drop. Hence, the presence of leakage to the atmosphere from the reservoir side of the feed grooves of the triple valves (AB service portions) will add to the leakage to the atmosphere from the brake pipes and will increase the amount of air that flows to maintain leakage while the brakes are released. The aggregate of brake pipe and reservoir leakage is known as system leakage as distinguished from brake pipe leakage alone as determined from the A.A.R. leakage test. An abnormal difference between brake pipe leakage and total system leakage on a train in actual service will give different results, always in the direction of greater gradient than expected. This is because the total leakage flow which establishes the value of the gradient is greater than that required to maintain brake pipe leakage alone.

Under laboratory conditions it is possible to obtain an exact measurement of the gradient or brake pipe taper because the end of the train can be relatively close to the front of the train and the difference in brake pipe pressure measured by the use of a manometer or other accurate differential pressure measuring devices. Such accuracy is practically impossible to obtain on a made-up train standing in a railroad yard. Most observations are made from reading the brake pipe gage on the locomotive and the brake pipe gage in the caboose. For special tests carefully calibrated and matched air gages may be used, but in ordinary practice rarely are. Even if the best test gages are employed their accuracy is rarely better than plus or minus 1 p.s.i. which could immediately lead to a discrepancy of as much as 2 p.s.i. in the determinations of train taper. The usual locomotive and caboose gages are frequently much less accurate and in some cases have been observed to be as much as 4 or 5 p.s.i. off when compared with an accurate test gage. It is quite important, therefore, to recognize the approximate character of gradient readings on trains in actual service.

The location of existing brake pipe leakage has a serious effect upon the fully charged brake pipe gradient. Since the A.A.R. leakage test cannot indicate to the engineman where in the train the leakage is located, apparent discrepancies will frequently be noted in the gradient attained on two trains of the same length and brake pipe leakage. The more uniformly the brake pipe and system leakages are distributed throughout all the cars, the more nearly will the gradient approach what is expected from laboratory results. Invariably a gradient far greater than that expected will mean (a) that the brake pipe leakage is concentrated at the rear of the train or (b) that there is an abnormally large system leakage perhaps also towards the rear of the train. Since the gradient is established by pressure drop of air flowing through the brake pipe to the points of leakage, the gradient will be greater as the air flow is larger and as the distance through which the air must flow is increased.

Variations in Leakage

The lowest levels of pipe leakage and gasket leakage are recognizable from soap bubble tests. Seep leakage may be considered the sort that results in a froth of fine soap bubbles when soap suds are applied over the entire area of a joint. It is of a low value in terms of actual air lost. Although difficult to determine exactly, seep leakage appears to represent values up to a maximum of about .001 cu. ft. of free air per min.

Leakage of a somewhat greater magnitude is recognizable by one or more growing soap bubbles which collapse within a short time. The maximum leak that will allow a soap bubble to be formed even for a brief time appears to be of the order of .14 cu. ft. of free air per min. Any single leak larger than this cannot be readily detected by soap suds because the velocity of escaping air is too great. A leak of this magnitude may be barely audible if there is no extraneous noise. A leak of the magnitude of roughly, 30 cu. ft. of free air per minute or greater generally is audible to the average person under the ordinary noise levels of a train yard or repair track.

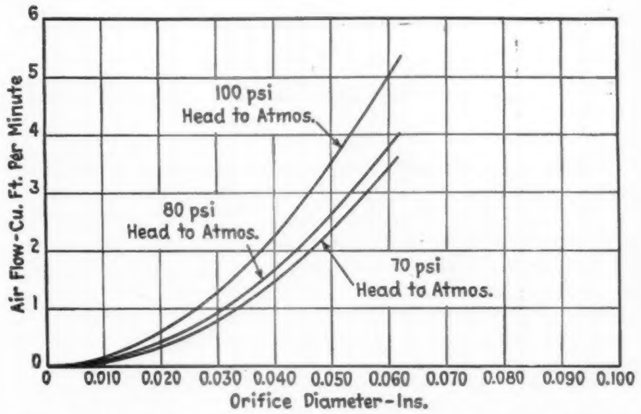


Fig. 1—Air flow in cu. ft. of free air per min. from charged pipe to atmosphere through small orifices

Fig. 1 presents curves of actual air flow to the atmosphere through various size orifices from head pressures of 70 p.s.i., 80 p.s.i., and 100 p.s.i. It will be noted that from 70 p.s.i. an air flow of .14 cu. ft. will occur through an orifice of .013 in. diameter, or slightly smaller than a No. 80 drill, and .30 cu. ft. through an orifice of .0185 in. diameter, or slightly larger than a No. 77 drill. A No. 57 drill orifice of .043 in. diameter will pass approximately 1.7 cu. ft. of free air with 70 p.s.i. head pressure and 1.95 cu. ft. per min. with 80 p.s.i. head pressure.

If on a car there is a leak to the atmosphere from the reservoir side of the triple valve of sufficient magnitude to prevent any pressure to be developed while charging is taking place through the AB valve, the maximum loss of air will be limited to the flow capacities of the charging chokes (feed grooves). The size of these orifices are a No. 57 drill in the service portion and a No. 73 drill in the emergency portion. The curves of Fig. 1 show that when the brake pipe pressure at the triple valve is 70 p.s.i., the total air flow would be approximately 2.25 cu. ft. of free air per min. This would, of course, be the extreme case and intolerable in service in that the brake would never become charged and would never apply on an application test. If the leak from the reservoir side is of such magnitude as to allow the reservoirs to become charged to only 45 p.s.i., the size of the orifice through which air is lost to the atmosphere would be almost exactly the same as the combined sizes of the charging chokes. Under these conditions the actual air lost through leakage would be approximately 70 per cent of the maximum or 1.6 cu. ft. of free air per minute. This condition again would be intolerable since the brake would not apply on an application test.

The maximum air leakage from the auxiliary reservoir that could be tolerated on a single car, where the brake pipe leakage is 5 p.s.i. per min., is approximately 0.5 cu. ft. of free air per min.; and where the brake pipe leakage is 2 p.s.i. per min., is 0.2 cu. ft. of free air per min. Therefore, if a train of cars shows a brake pipe leakage of 5 p.s.i. per min. on the A.A.R. leakage test, each car of the train must have the leakage on the reservoir side reduced to 0.5 cu. ft. per min. or less for the brake on that car to remain applied during the application portion of the terminal test. This sort of leak should be in the audible zone and, consequently, readily detected during terminal inspection.

What Establishes the Gradient

Now, how will such train system leakage affect the gradient? Let us assume for one case that all cars in a 100-car train have uniformly a leakage from the reservoir side of the triple valves of 0.5 cu. ft. of free air per min. from a head pressure of 70 p.s.i. This leakage will make the system leakage of the train far larger than any tolerable brake pipe leakage. It cannot be assumed that the leakage flow will be increased by 50 cu. ft. per min. (100 by 0.5) because the gradient will not produce the 70 p.s.i. head pressure in any except the first few cars of the train. Actually, the additional leakage flow will be somewhat less than 50 cu. ft. per min., say, 40 cu. ft. per min. This would add to the flow required to maintain the brake pipe leakage of 5 p.s.i. per min., which under these circumstances would amount to about 25 cu.

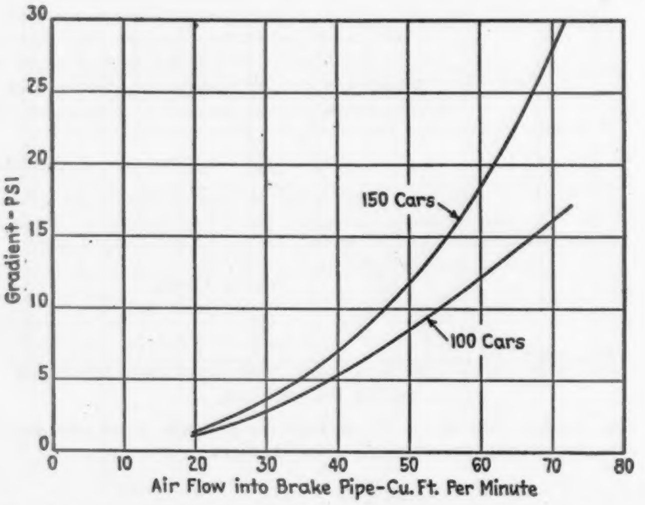


Fig. 2—Gradient caused by flow of air to maintain uniformly distributed leakage with 80 p.s.i. brake pipe pressure

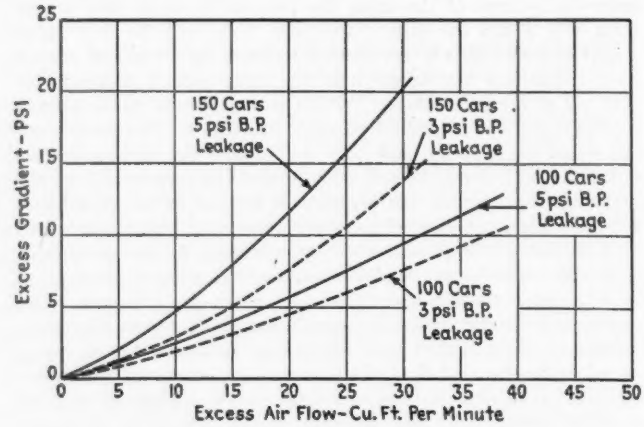


Fig. 3—Excess gradient resulting from excess system leakage. Leaks uniformly distributed with 80 p.s.i. brake pipe pressure

ft. per min. and the result would be a total flow of approximately 65 cu. ft. per min. Fig. 2 is plotted from laboratory tests to show the gradient in 100 and 150 car trains that results from a total air flow of various magnitudes supplying uniformly distributed leakage. Were there practically no additional system leakage the air flow to maintain 5 p.s.i. per minute brake pipe leakage on a 100-car train would be approximately 30 cu. ft. per min. From the 100-car train curve of Fig. 2 it will be observed that the gradient would be approximately 3 p.s.i. where the brake pipe and system leakages are substantially the same, but increased to approximately 14 p.s.i. by the addition of the reservoir leakage assumed in this case.

The gradient in trains having the same brake pipe leakage increases quite rapidly with an increase in train length. To illustrate how the presence of additional system leakage produces the same effect to a startling degree, let us assume a 150-car train with the same conditions of brake pipe leakage and total system leakage as outlined in the paragraph above. The additional air flow due to reservoir leakage would be about 55 cu. ft. per min. and the total air flow about 85 cu. ft. per min. The air flow to maintain 5 p.s.i. per min. brake pipe leakage alone would be about 40 cu. ft. per min. From the 150 car curve on Fig. 2 it will be noted that the gradient would be approximately 7 p.s.i. where the brake pipe and system leakages are substantially the same, but would be increased to approximately 46 p.s.i. by the addition of the reservoir leakage. This point is not even shown on the curve of Fig. 2.

As a train is made up and its charging is started, there is no way of telling what leakage may exist or where it is located. There may be a car or two with broken crossover pipes or other causes of excessive reservoir leakage. There may be a number of serious brake pipe leaks at hose coupling gaskets, angle cock connections, 10 in. nipple couplings, etc. Certainly it cannot be expected that every car has zero reservoir leakage or an aggregate system leakage that is the maximum tolerable on a single car basis. Let us, therefore, take another case which may be more practical in its assumptions. Assume that a train of 100 cars on which work has been done while it is being charged to the extent that the brake pipe leakage has been reduced to 5 p.s.i. per min. In this train there are two cars, one towards the front end and one towards the rear with broken crossover pipes which leak to the extent of preventing these individual cars from obtaining a satisfactory charge. Leakage from these cars may run all the way from 0.7 to 2.25 cu. ft. per min. On 20 other cars uniformly distributed through the train there are auxiliary reservoir leaks which are in the lower level of the audible zone, each producing a loss of about 0.3 cu. ft. per min. The total flow to maintain the brake pipe leakage would be about 30 cu. ft., and the total flow for all leakages would be about 40 cu. ft.

From Fig. 2 it will be seen that the additional 10 cu. ft. per min. air flow would increase the gradient about 2.5 p.s.i. In a 150-car train with the same proportion of cars with an equal degree of leakage, both in the brake pipe and reservoir systems, the extra flow caused by reservoir leakage would be approximately 15 cu. ft. per min. and the gradient would be increased from 7 p.s.i. to 15 p.s.i.

The above hypothetical cases may not appear to fit any actual service conditions. They are intended to disclose the influence of system leakage, both in magnitude and in trend, following increasing train lengths.

To illustrate graphically and understandably the influence on gradient of system leakage other than that from the brake pipe alone is rather difficult. Fig. 3 attempts to do so for train lengths of 100 and 150 cars with 3 p.s.i. per min. and 5 p.s.i. per min. brake pipe leakage. The values given represent the excess gradient beyond that produced by the brake pipe leakage alone. If system leakage and brake pipe leakage are the same, there is no increase in the normal gradient. From the 100-car train curve (solid line) it will be noted that when system leakage is such as to require 20 cu. ft. per min. greater flow than that required to maintain a brake pipe leakage of 5 p.s.i. per min., the gradient will be 5.5 p.s.i. greater than normal. It is readily apparent that as the train length increases less reservoir leakage can be tolerated. The values given are for a uniform distribution of both brake pipe leakage and system leakage.

Soap Suds Test Is Sound

It should be clear that in maintenance practices attention should be directed to reductions of leakage in the reservoir system of cars as well as in the brake pipe system. The single car code of tests includes a brake pipe leakage test which holds brake pipe leakage to no more than 2 p.s.i. drop in pressure in 1 min. There is also an auxiliary reservoir leakage test which limits auxiliary reservoir leakage to a reasonably low value. There is, however, no test for emergency reservoir leakage and no practical operating test can be devised to indicate and hold such leakage within tolerable limits. The common practice is to apply soap suds to points of possible leakage within the reservoir system while the equipment is being charged. This appears to be the only practical way of locating and eliminating emergency reservoir leakage and should be rigorously practiced. In fact, the practice of soaping all points of possible system leakage is very sound, since small leaks can thus be detected and eliminated before they become serious.

Further questions have been raised concerning the effect of feed valve setting upon the gradient of a particular train. At brake pipe pressures commonly used the amount of leakage through a given hole is a function of the density of the air within the reservoir or pipe, which in turn is directly proportional to the absolute head pressure. It follows that as the feed valve pressure

is increased, the amount of air lost through leakage will be correspondingly increased and the flow to maintain this leakage will be increased. Increasing flow means increasing gradient so that a given train with a certain leakage condition will have a greater gradient at 80 p.s.i. brake pipe pressure than at 70 p.s.i., and still more at 90 p.s.i. For instance, a 100-car train with a 3 p.s.i. gradient at 70 p.s.i. feed valve setting would have a 4½ p.s.i. gradient at a feed valve setting of 90 p.s.i because the actual air flow would increase by about 25 per cent.

There is also the probability of some effect of the higher pressure on the size of the leakage orifices, such as greater stressing of loosened joints. This, in itself, may add to the air flow and, consequently, make the gradient even greater.

A helpful device for indicating the presence of excessive leakage is a brake pipe flow indicator on the locomotive. If it is the type with graduated dial and indicating pointer, the level of flow will have a fairly uniform indicated value for a given normal gradient for a certain number of cars. On a train of a given number of cars with a fairly uniform distribution of leakage which produces a tolerable gradient, the flow indicator will show a normal reading for that train length. It will soon be recognized from the dial indication that any train of the same length which shows a considerably higher reading must have excessive leakage and gradient. From watching the flow indicator this will become apparent before an attempt is made to run the terminal leakage test. Experience on many trains of different lengths will develop empirical maximum indications within which satisfactory operating conditions of trains could quickly and readily be judged.

There is need for careful policing of yard and repair track maintenance work. There are certain factors relating to air flow and pressure loss which you cannot alter. The size of the brake pipe has been established for many years as a good compromise between excessive volume and excessive restriction and the brake system devices have been built and calibrated around it. Modern feed valves have been increased in capacity to a point where they promptly establish and maintain their set pressures at the front end of trains of any practical length. The laws of flow through pipes and restrictions cannot be changed nor can man do anything about the amount of air that will be lost through a leakage orifice of a given size. But everyone can aid in reducing the number and size of leaks in the brake system. This requires constant vigilance and careful supervision of maintenance practices, not only at one point, but at all points on all railroads.

The report was prepared by H. N. Sudduth, director of air brake engineering, New York Air Brake Company.

Discussion

Opinions were expressed on the necessity of getting the information in this paper to the car knocker, on providing sufficient time and means for checking leaks, on the need for more men if we expect to continue to run long heavy trains, and on acquainting top ranking car department officers with the effects of leakage so that they will understand the problems of the air brake man. One member said that all would agree that this was a fine paper but what is being done about it? The A.A.R. asked that leakage and piston travel be adhered to 18 months ago, but it is doubtful if half of what can be done is being done. There are not enough air brake men today yet management is taking men off where more are needed. In checking in-date cars this member found that many AB valves in service only 18 months require repairs, and that many repairs are being made that are not proper. Unless these conditions are remedied the large investment in diesel power will be largely wasted because, with excessive leakage and gradient, you cannot safely handle long trains. Coal oil is being found in parts, indicating that "coal oil repairs" are being made, meaning just washing off the outside and calling it a job. Another member said that air brake conditions are the best ever and is therefore worried that things will get far worse as car department officers will begin to think that the air brake problem is solved completely. Air brake failures are now a minor item on his delay sheets. He thinks that this paper gives excellent ammunition with which to go to the management to illustrate the problems that the air brake man is facing.

One speaker felt that the rip track is where the improvement is needed. The A.A.R. tells what to do but is unable to get compliance. This information can go to car department men but will it help when they won't even comply with simple rules? It is not difficult to understand a rule requiring leakage to be kept to 2 p.s.i. per min., another requiring that reservoirs be tight, etc. Too many rip tracks don't even know what a soap bucket is and don't pay attention to A.A.R. rules. It is here where improvement is needed. He did not feel that conditions were better than before. The causes such as loose pipes must be done away with. Making a one-day inspection of any rip track will show why this is where the improvement is needed, and that too little attention is paid to what the A.A.R. committee has done and what they recommend.

* * *

COORDINATED REGISTRATIONS—1950-1951

Associations	1950 Railroad Men	1951 Railroad Men
Air brake	176	280
Master Boiler Makers'	216	215
Car Department Officers'	373	563
Locomotive Maintenance Officers'	746	1,017
Railway Fuel & Traveling Engineers'	475	268
Electrical Sections, A.A.R.	175	155
	2,161	2,498
	Supply Men	Supply Men
Railway Electric Supply Manufacturers'	236	
Allied Railway Supply	737	
Allied Railway Supply, Mechanical	...	1,152
Allied Railway Supply, Electrical	...	168
	973	1,320
Total	3,134	3,818

Note: The 1950 exhibit was of electrical equipment and the 1951 exhibit was mechanical equipment. The supply companies' registration of representatives, therefore, is not directly comparable.

A. F. Stiglmeier
Sec.-Treas.
(General supervisor boilers and welding, N. Y. C. System)

R. W. Barrett
President
(Chief boiler inspector, Central Region, C.N.R.)

H. C. Haviland
Vice-Pres.
(Supervisor boilers, N. Y. C.)

Master Boiler Makers Broaden Scope of Association's Work

Recognizing the adverse effects of dieselization on the boilermaker's craft the Master Boiler Makers' Association took action at its 34th annual meeting to strengthen the association by giving more recognition to the allied fields of welding and water service. The association adopted changes to its constitution that permits welding and water service supervisors to become active members and officers, who heretofore have been restricted to boiler men.

President R. W. Barrett, who presided at the meeting, and Secretary-Treasurer A. F. Stiglmeier spoke to the membership on the association's work and status at the opening session. Each pointed out the need for additional active members and mentioned the efforts of the association in expanding its work to deal more fully with new subjects. Next year marks the 50th anniversary of the forming of the association and plans will be made to celebrate this event by a special program.

During the three-day meeting at Chicago, September 17-19, guest speakers made several suggestions for utilizing the experience and training of boilermakers in other than steam locomotive work. In an address before the opening session D. V. Gonder, assisant vice-president-operations, Canadian National, said the attitude of boiler makers should be, "Now that there is less steam locomotive work, to what other repairs and manufacture can my skill and knowledge be applied?" He said that it is time for the boiler maker to get out of the specialist class and learn a variety of work as "it is no use seeking other work if you know nothing about it."

Specifically, Mr. Gonder suggested that work that has gone to outside contractors, such as for the construction of oil and water tanks and the fabrication of smoke and heating ducts, might be done by the boiler department, provided costs meet outside competition. Other work might include the repair of structural steel members, stationary boiler repairs and steel car work.

E. H. Davidson, director, Bureau of Locomotive Inspection, said it "is economically unsound not to utilize to the utmost the trained services of men experienced in the art of boiler making." He suggested that the construction and maintenance of fuel oil tanks and reservoirs is a subject to which boiler makers could profitably direct their attention because oil leaks and inflammable debris have become troublesome problems.

In respect to steam locomotives Mr. Davidson said that "the introduction of a new type of motive power is not justification for the neglect of steam power." He urged the boiler makers to give more attention to the steam locomotives because, unfortunately, accidents seem to increase with the age of the equipment. Particular attention, he said, should be given to the condition of staybolt threads, parts of the wrapper sheet and back head where men work in close proximity to the boiler shell, and to the cleanliness of both external and internal heating surfaces.

Two reports, abstracts of which are not included in this issue, were presented at the meeting. One was a two-part report on (a)—the maintenance and testing of stationary and portable air reservoirs (other than locomotives and cars), and (b) the care and maintenance of stationary boilers. This report was presented by H. C. Haviland, supervisor of boilers, New York Central. The second report was on the fabrication and testing of stationary boilers and the chemical descaling of stationary and portable boilers. The chairman of the committee was S. F. Wentz, assistant supervisor of boilers, New York Central.

Feedwater Treatment Reduces Blowdowns — Controls Foaming

Any program involving tangible savings will be welcomed by the railroad management. A comparative study shows that boiler feedwaters conditioned to permit the carrying of high dissolved solids show savings in fuel far out-weighing the cost of additional chemicals used for this purpose. There are many intangible savings which should be considered but which are difficult to evaluate. Among these is the reduced maintenance of superheater units, valve bushings, and cylinder packing.

Dissolved Solids

The ordinary conception of dissolved solids consists of sodium carbonate, sodium hydroxide, sodium sulphate, sodium chloride and small amounts of nitrates. To these we must add sewage and organic contamination which has increased greatly with industrialization and increase in population. These developments have increased contamination of surface and shallow-well supplies by pouring vast amounts of sewage, synthetic detergents and wetting agents and other forms of pollution into the water supply. The corrosive action of these types of pollution is readily controlled by proper alkalinity but the foaming properties are sometimes not so easily handled.

Foaming

Control of foaming is the latest advance in the art of water treatment. From all the discussion emerging from the relative parts played by suspended matter and dissolved solids, it seems reasonably clear that dissolved solids is the major cause of the difficulty. The early method for the control of foaming was excessive blowing, frequent water changing and boiler washing. One early preventative was the use of castor oil, this material being only a partial solution because frequent water changes and washes were still necessary. The most recent advance was the introduction of pulverized steam conditioners which prevent foaming at unbelievably large total solids. This compound does not saponify or form soap in the boiler and has a much longer effective life than the old oil type antifoams. Furthermore, it does not form objectionable compounds which require removal by frequent washing and water changing. When using it the boiler washes can be reduced to the legal limit and water changes entirely eliminated. Obviously, the longer we can keep the conditioned water in the boiler the less the danger of scale and pitting from the fresh water refill.

Conclusions

On one northwestern railroad using steam conditioner, organics, phosphates and the usual water treatment, the engines are dispatched from the terminal with total solids of 1,000 grains per gal. On another railroad using similar treatment, total solids between 700 and 1,800 grains per gal. are normal. On a branch line total solids as high as 3,400 grains per gal. have been safely carried. Corrosion, pitting and grooving are non-existant in the cases mentioned. The evidence is conclusive that there will be no attack on the boiler metal at exceedingly high total solids provided the alkalinity is maintained at proper levels at all times with the addition of a mixture of organics and polyphosphates in small amounts.

Oil has no place in a boiler. Under no circumstances should it ever exceed one percent of the suspended matter. The damaging effects of oil have been overlooked and disregarded largely because of the difficulty encountered in making the mechanical changes necessary to prevent oil from getting in a boiler.

In the early days of water treatment the economics of carrying high dissolved solids and the elimination of water changes and washes could not be realized because of foaming. The introduction of powdered steam conditioners has changed the picture so that foaming is the least of our difficulties, permitting us to carry total solids to any point, thereby realizing the economy of reduced blowdown and boiler washes.

The report was submitted by a committee of which F. E. Godwin, system chief boiler inspector, Canadian National was chairman.

Effects of Boiler Supports and Machinery Pounds on Boiler Failures

While the opinion has been quite generally held that the causes of boiler shell and casing failures have their origin in the boiler itself many supervisors of boiler maintenance and construction have doubted this theory for a long time. In many instances regardless of the strength employed in making repairs, failures continued to occur at the same location.

Based upon information obtained through limited surveys this committee believes that pounds, broken frames and stuck or gauled expansion shoes do have a direct bearing on boiler maintenance and that their effect can be unmistakenly traced. It is our recommendation that where boiler waist sheets are used that a sliding type be employed with a large wearing plate between boiler and waist sheet angle, for better shock dissipation, and that waist sheet angles be maintained with a close fit to boiler at all times, to reduce severity of pound. Where expansion shoes are employed they should be closely inspected and if worn more than 1/16 in. should be removed and properly restored to their blue print measurement. The practice of inserting shims to take up excessive wear in expansion shoes should not be tolerated. They do not compensate properly for unevenly worn shoes and are applied without oil grooves and frequently are applied too tight thereby preventing free movement of boiler on shoes.

If expansion plates are used at front or back of firebox careful inspection should be made at all times to note whether they are broken or cracked or whether their free movement is restricted due to an accumulation of dirt or other foreign matter. When defective expansion plates are detected immediate repair should be made so that they can function as intended. If rocker castings are employed at rear of engine bed they should be checked to see that they have not become worn away from the proper radius. These castings when not in true radius prevent the free side movement of frame and boiler while engine is curving, holding it fast momentarily and then releasing itself sharply causing undue shock and strain to both boiler and frame.

Canadian Pacific

In answer to a questionnaire W. A. Newman, chief of motive power and rolling stock, Canadian Pacific, indicates clearly that fairly good conclusions as to the causes for certain boiler failures can be reached if only enough time and study are given to the subject. After citing some specific cases Mr. Newman concluded his report as follows:

"It is very difficult to determine whether pounds due to improperly maintained rod bearings, driving boxes, shoes and wedges are responsible for boiler shell failures, but judging from our experience on the 4-8-4 type locomotives and the twenty earlier 2-10-4 type locomotives coupled with exceptionally good results on high speed 4-6-4 passenger type locomotives, I am forced to believe that pounds due to improperly maintained bear-

ings, etc., have little effect. Boiler waist sheets fastened to both boiler and frame should not be a contributing consideration providing the waist sheet is long enough to be flexible, to take care of the longitudinal expansion in the boiler shell at the point where it is applied.

"We have no reason to believe that improper maintenance of floating boiler waist sheets is responsible for boiler trouble. I do believe, however, that improper fitting of the waist sheet to the boiler barrel can cause trouble as we have seen evidence of the outer section wearing the boiler shell or the liner applied under same, indicating that the radius was formed so that it would fit tightly at the outside and not in the center. Also this wear may be due to the diametral expansion of the boiler shell, the expansion being restrained at the outer edges of the waist sheet angle or T-irons. For this reason I think it is desirable to allow a slight clearance between the shell and the outer portion of the angles or T-irons. Improperly maintained expansion plates under the firebox or expansion shoes can definitely contribute to boiler shell failures."

The report was presented by the committee chairman, A. A. Edlund, assistant general boiler inspector, Chicago, Milwaukee, St. Paul & Pacific.

Washing and Testing Steam Generators

This topic was presented as individual reports by the committee members. Because of the length of these reports only the one prepared by the committee chairman, S. H. Christopherson, supervisor of boiler and welding inspection, New York, New Haven & Hartford, appears in this issue.

Mr. Christopherson's Report

The cure, we believe, for the failures of steam generators will be the same as we have advocated for years in our proceedings on steam boilers, only it may be placed before us in a different language. We do believe that part of the cure lies with the builders of diesel locomotives and their representatives who apparently view the steam generator as a secondary device that can be placed wherever there is room for it. This makes proper maintenance a slipshod affair. For in order to function successfully during the trip a general inspection of each operating part under orifice test must be made. We have yet to find a supply water tank placed and built on a diesel locomotive so that it can be properly washed out and kept clean. These water supply tanks must be built so that no obstruction will stop the flow of water at the bottom when washed, as practically all sediments will be found at the bottom.

Washing Procedure

The washing of steam generator coils is done in accordance with I. C. C. rules. The railroads have adopted the acid wash. Ever since 1941 acid has been used as an agent to clean out coils. The acid wash was used at every boiler wash up to 1949 when it was decided to use the acid wash only on quarterly inspection and so far we have seen no difference. However, if for any reason a report comes in that the water relief valve on water pump let go or of high water pressure on the gauge the generator is given an acid wash. After a thorough wash with acid, using soda ash for an inhibitor in clean water, the generators are filled with water and fired up and with a steam pressure of at least 245 lb. the coils are back blown several times until clean water comes out from the generator coil blow down valve. This back blow of the coils is done repeatedly at all terminals upon arrival regardless of the time between runs.

After being thoroughly back blown the generator is then filled and fired up and an orifice test applied for a short period and a general inspection given while under this test. During the early period, 1941 to 1948, the generator water was treated, using the treatment tank as means of supplying treated water to coils. This way of treating water did not lengthen the coil life.

Coil Repair

In the early years of the generators, erosion corrosion would develop within 24 months in the outer coil at the inlet and outlet. The construction of these early coils may have had something to do with the failure as the tubes were bent quite sharply at the inlet and outlet. This failure also occurred in the intermediat coils within 28 to 32 months. This condition of a sharp bend was rectified in the later years and a general corrosion now takes place starting from the nipple connection to the inlet and outlet of both the outer and intermediate coils and we have found this corrosive action in the intermediate run of the outer coils way up near the top portion of the coil assembly. The inner coil has outlasted both the outer and intermediate coils. The defects found at the inner run of inner coil has been sometimes a stress crack or may be a pin hole, which would develop in 32 to 36 months. If it was found that the material could be welded these pits or cracks were welded up.

When these coils were finally removed certain repairs were tried out such as a complete length of new tubing (about 20 ft.) would be rolled to fit the coil in question—this new tubing would take in about three runs in the outer run of outer coil and about four runs in the inner run of outer coil. This type of repair would last about 18 months or less when corrosion would take place in the old tubing just ahead of new tubing applied previously.

As this had to be a continuous job of removing and reapplying coils and gave us no assurance of comfort during the winter months it was decided that no further repairs as mentioned would be made on coils found to be four years old upon removal. This has proved to be the right thing to do on the New Haven. However, we would suggest that each railroad check the life of each coil and then draw up a plan for renewal. In fact, on the later 4530 and 4630 steam generators we had to set up a plan for renewal of the coils after three years of service. These generators came to us in the latter part of 1948 and early part of 1949 and within 19 to 23 months the outer coil developed defects and had to be renewed. The most peculiar part is that the outer coils which were renewed have given us trouble within 9 months. During the summer of 1951 we hope to renew all coils and start with a new set of coils. To cure this trouble we believe that a water treatment must be used in the supply tank and the tank must be kept clean. The 4530 and 4630 have never used treated water.

Heavy Repairs

On diesel units coming into shop for heavy repairs we have a standard procedure in that we remove generator and separator complete and place them at designated place. Where every device and appurtenance is removed it is either washed or cleaned by whatever method used for each device. The coils are removed and a check is made of their age and condition. If found to be usable all coils are placed within each other and placed in a furnace and annealed at about 1,000 to 1,200 deg. F. We believe this procedure will give new life to coils and at the same time loosen up anything that will adhere to the inside of coils. Coils are then given a thorough wash, alternating with steam and water and using a hammer continuously on all parts of coils while under this wash.

After being satisfactorily cleaned, coils are then given a hydrostatic test at 600 lb. If defects are found under hydro and coils are above age limit. If within nine months of limit the coils are scrapped, if above that, shop is so equipped that we apply a full length of tubing, rolling coils upon drums of different diameter which will fit the inner run or outer run of any coil as may be needed. The coils so repaired are sent to the terminal for their use.

Shops do not use repaired coils on renewal. All coils applied by shop are new coils. All refractories are removed from containers and recast, using home made forms.

Corrosion

One of the most frequent causes of corrosion in heating boilers as now used on diesel power is failure to care properly for idle boilers and water supply tanks. However, we feel that improvement could be made by the builders in using the known fact that we have today coatings which will stop practically all oxidation of water supply tank material. We believe an unclean tank will shorten the life of coils.

In comparison with other railroads the New Haven has short runs but the utilization is very much the same except that units are operated at high capacity for a period of four hours and then shut down. During this idle period all water which is in the coils will evaporate and whatever total solids are in that water will bake onto the metal. The records show that during 1948 and 1949 twenty-seven 3,000-lb. generators were received and operated for a period of 16 to 20 months before it became necessary to renew the outer coil owing to corrosion. During this time the tank water was getting pretty had, occasionally the water flow indicator would black out. Inside of nine months with the second renewal we were in trouble again and it is our opinion that the wording of how to maintain a water supply tank is wrong—it states it should be flushed out. This to us as boilermakers means just a change of water. Water supply tank should be thoroughly washed at least once a month and have sufficient washout plugs.

All-Welded Replacement Boiler Shell

The committee presenting the report on all-welded boiler shells noted that the assigned topic was the all-welded boiler but because present interest lies almost entirely with the all-welded fabrication of boiler shells it confined its report to this subject.

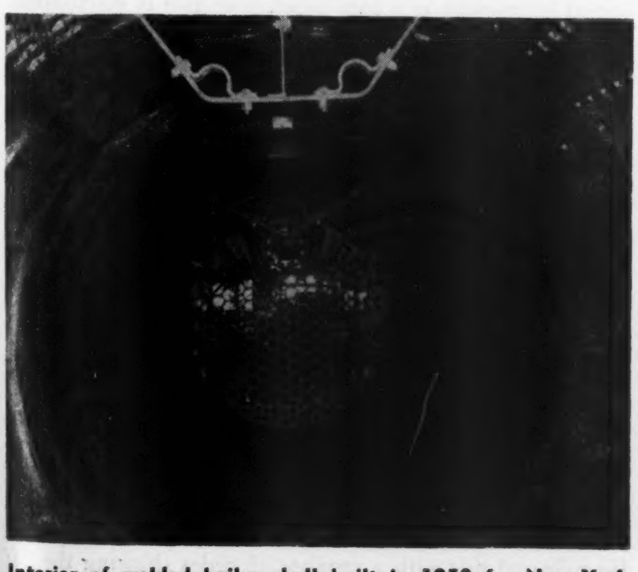
The all-welded boiler shell assembly was developed as a replacement shell for the riveted boilers, the riveted shells of which were proving to be an increasing source of trouble, especially on boilers constructed during the previous ten years. These boilers were designed to meet the requirements for additional power and their designs introduced:

(1) Alloy Steels in the construction of locomotive boilers.
(2) Larger capacity boilers, within restricted weight and clearance limitations.
(3) Higher boiler pressures.

The results were an epidemic of cracked boiler shells, with the cracks concentrated in the riveted longitudinal and circumferential seams. The causes of this cracking were fully covered in the 1947 and 1948 Proceedings of the Master Boiler Makers' Association and the answer is still the same—the all-welded boiler or its smaller component the all-welded shell assembly.

As this condition developed principally on the modern steam locomotive, which, under most circumstances, would undoubtedly be the locomotives delegated to the role of secondary power in any dieselization program, the use of the all-welded shell assembly as an economical means of extending the life of these locomotives was the most logical answer.

The construction of the all-welded shell assemblies in the various plate fabricating shops who have undertaken this work, has followed the procedures of welding as covered in the A.S.M.E. Code for Locomotive Boilers. Thee procedures are everyday practices in these shops and the additional requirements of the railroad company specifications once understood and agreed upon were quickly absorbed into their routine operations.



Interior of welded boiler shell built in 1950 for New York Central's Class J3A locomotive by Combustion Engineering-Superheater, Inc.

SUMMARY OF ALL WELDED BOILERS AND BOILER SHELLS BUILT TO DATE

Railroad	Boilers	Shells	Date Built
Delaware & Hudson	1	..	1937
Delaware & Hudson	1	..	1947
Chicago & Northwestern	5	..	1946
Chesapeake & Ohio	5	..	1946
Chicago, Milwaukee, St. Paul & Pacific	10	..	1947–1948
Canadian Pacific	12	..	1945
New York Central	1	..	1945
New York Central	..	24	1948
New York Central	..	10	1949
New York Central	..	20	1950
New York Central	..	12*	1951
Atchison, Topeka & Santa Fe	..	25	1950–1951
Northern Pacific	..	10	1950–1951

* On order.

These first groups of all-welded shell assemblies were complete ready for application to the smokebox and firebox of the boiler with practically no work to be done on the shells in the railroad company shops. It soon developed that a large portion of the cost of these shell assemblies was in the fabrication and application of parts that could be more economically applied to the shells in the railroad company shops and in doing so eliminate the work that was foreign to the welded plate fabricating shops. Thus the latest all-welded shell assemblies consist only of the first, second and third shell courses, with such parts as liners, front tube sheet flange rings, etc., that are considered integral parts, welded to the shell, simplifying the job for the plate fabricating shops and permitting the railroads to utilize to the full extent all usable parts from the existing riveted shells, thus keeping to a minimum the cost of the repairs.

Reports received from the majority of the railroads with all-welded boilers and shells indicate that they have proven satisfactory in service with no repairs to the welds or welded areas to date, thus increasing availability of locomotives as compared with their performance when equipped with riveted shells.

The report also covered the details of the application and testing of shell assemblies in the railroad shops.

The report was submitted by a committee of which G. M. Davies, assistant engineer equipment, N.Y.C., is chairman.

Discussion

How long does it take to apply a welded shell? The New York Central takes about three weeks, the Santa Fe averaged one a month at Albuquerque, the Northern Pacific required more time. The variations in time are dependent on how complete the boiler shell is when delivered.

In answer to a question by M. R. Francis, general boilermaker, Norfolk & Western, on repairs to welded boilers, the answer was that these repairs are made in the same manner as those made to riveted boilers.

Diesel Subjects Dominate Traveling Engineers' Meeting

Locomotive operation, train handling, fuel storage and personnel training discussed. Steam fuel economy also considered

G. E. Anderson
President
(General fuel supervisor, Great Northern)

R. H. Francis
Vice-Pres.
(General road foreman, equipment, St.L.-S.F.)

L. H. Peters
Sec.-Treas.

A PROGRAM of 15 papers, reports and addresses in which subject matter pertaining to diesel locomotives and their operation predominated heavily over those dealing with steam was presented at the annual meeting of the Railway Fuel and Traveling Engineers' Association at the Hotel Sherman, Chicago, on September 17, 18 and 19. Seven items dealt with diesel locomotive operation, diesel fuel handling, diesel steam generators, and the education and training of diesel-locomotive operating personnel. Train handling, including both passenger and freight, and dynamic braking was the subject of a session in which the members of the Railway Fuel and Traveling Engineers' Association were joined by those of the Air Brake Association. Two reports dealt with fuel economy on steam locomotives, one on coal-burning service and one on oil-burning service. Three papers were on general subjects and the gas-turbine locomotive was the subject of one.

In opening the meeting President G. E. Anderson, general fuel supervisor, Great Northern, referred to developments of the past 50 years, including the advent of the diesel power with its greater availability, long runs, faster transportation, greater safety, better visibility, and greater comfort for the engineman. With the rapid change in motive power, he said, road supervisors all must become more alert and ready to help keep all men in the engine service fully informed.

Addresses

Edward H. Davidson, director, Bureau of Locomotive Inspection, in an address, reviewed the history of the organization and development of the Bureau of Locomotive Inspection and stressed the basic fact that "a well-maintained locomotive is a safe locomotive and is economical and efficient within the limits of its design. . . . Your organization," he said, "and we of the Bureau of Locomotive Inspection have much in common. We are charged with administration of the Locomotive Boiler Inspection Act and rules formulated thereunder and are definitely interested in matters affecting locomotive safety. As we succeed in raising the safety standard by elimination of locomotive defects, so we should be of assistance in your improvement of locomotive operation."

During the meeting John M. Hall, retired chief inspector of the Bureau of Locomotive Inspection, was called upon and spoke briefly.

The Gas Turbine

R. A. Williamson, manager, Railroad Rolling Stock Division, General Electric Company, reviewed the present status of gas-electric locomotives in the United States and elsewhere in the world, including the General Electric locomotive which has been in service on the Union Pacific. He followed this with a number of slides showing the 10 locomotives of this type now under construction for the Union Pacific in the General Electric plant at Erie, Pa.

When the operation of the G.E. locomotive was concluded on March 31, 1951, Mr. Williamson said that it had run about 95,000 miles in regular freight service on the Union Pacific and had burned about 1½ million gallons of fuel oil, about 95 per cent of which was heavy oil. Including service on other railroads, the locomotive had run a total of 106,000 miles, had burned 1,800,000 gal. of fuel, and had produced about 364,000,000 gross ton-miles.

Mr. Williamson reported a bucket failure in the second stage on the turbine rotor which produced relatively little other damage. The failure was attributed to fatigue produced by the resonance of the bucket to a particular operating speed not sufficiently above the actual operating speed of the turbine. A new rotor was installed and a new first stage nozzle also put in.

Abstracts and summaries of most of the papers and reports follow. In addition to those which appear here was an address on Safety on the Railroad, by W. H. Roberts, superintendent of safety, Chicago & North Western, a general survey of air pollution from all sources by Glenn Warner, fuel supervisor, Pere Marquette district, Chesapeake & Ohio, and a paper presented by F. Thomas, assistant to general superintendent equipment-diesel-electric, New York Central System, in which he outlined the functioning and controls of the Elesco and the Vapor-Clarkson steam generators for diesel locomotives.

C. H. Morse, Jr., manager, locomotive service department, Railroad division, Fairbanks, Morse & Co., answered 17 questions concerning the rating and various aspects of the functioning of diesel-electric locomotives. This paper will be the basis of an article which will appear in a later issue.

During the meeting President Anderson announced that the association now has a book of questions and answers for enginemen on Diesel-Electric Locomotives—Questions and Answers on Machinery, Air Brake and Operation, which sells for $2.

Employees' Contribution to Good Public Relations

By L. W. Horning

Vice-President, Personnel and Public Relations,
New York Central System

We sometimes hear it said that industry in general has only recently discovered that it has employees, and that it has a public. This is not to imply that industry traditionally has ignored these groups, but rather that it hasn't always applied to its relations with them the same degree of effort and skill that it has used in dealing with the more mechanical aspects of its existence. As a result, understanding between employees and management, and between public and management, has suffered; and all three parties have been the losers thereby.

In one way or another, all of you are in a position to influence the way a certain number of railroad men carry out their work assignments. Either by direct supervision, or by your work as technical staff men, you are in touch with the daily process by which the railroads produce their only stock in trade, their only marketable commodity—transportation. Occupying this strategic position—in or near the front line of supervision—you constitute management's most potent force for reaching the broad ranks of its employees. In brief, you are most opportunely situated for influencing railroad employees to exert the great power of which they are capable on behalf of their company's public relations.

Before you can address yourselves effectively to this task, however, you must yourselves be firmly convinced of the absolute indispensability to the railroad industry of sound, favorable relations with the public. To be thus convinced, you must face frankly some of the blunt facts about the present status of your industry. First, you must realize that the railroads are meeting with aggressive competition for the business which they need in order to operate profitably and continue to provide good jobs and opportunities for advancement. To win out over the competition, the railroads must persuade prospective shippers and travelers—meaning most of the public—that their best transportation buy is rail. Secondly, you must realize that the railroad industry—probably more so than any other—is subject to control by public agencies and to pressures of various kinds from public groups. Without good will and understanding on the part of the public, a railroad's life is likely to be harried by repeated persecutions and discriminations. Insofar as railroads presently suffer from just such harassments, relief will have to come largely as a result of improved public attitudes.

Indirect Influence

For practical purposes it may be helpful to center our discussion principally around engine-service employees. In the case of train service, the importance of public relations-conscious conductors and brakemen is obvious, just as it is at the ticket window and on the telephone. But in engine service, the field with which you have most contact, the connection between employee and public may not be so readily apparent.

Engine crews ordinarily have no personal contact with the passengers who ride, or the shippers whose goods ride, on their trains. Yet the men in the cab have a lot to do with whether the passenger enjoys a comfortable ride, and with whether the freight shipment arrives in safe and sound condition. The extra care that makes the difference between jerky starts and stops and cushion-smooth ones is something that rests in the engineman's hands. The handling of cars in freight yards—where shippers are won and lost—demands an engineman who knows his stuff and applies what he knows. The switching of passenger cars in terminals, particularly at night when passengers are sleeping, presents an opportunity for the engineman to make—or lose—friends for his railroad.

You need no reminder of the public relations problems that are created when engine crews fail to observe smoke control regulations in your communities. No explanations or excuses are going to pacify people who see a railroad's locomotives violating promises the railroad has made, breaking rules the railroad has agreed to keep. No statements by high railroad officials will carry one-tenth the weight with the public that the daily performance of the men in the engine cabs will.

Off the Job

The instances cited show some of the ways in which railroad employees of one class can practice public relations on the job. Not to be overlooked are the public-relations opportunities which they, and all railroad employees, encounter off the job. As members of their communities, and of various groups therein, they have wide circles of contact. The attitudes they reflect toward the company are going to help shape the opinions of their friends and acquaintances toward that company. The pride, or lack of it, they exhibit for the transportation product their company sells is going to influence those friends' and acquaintances' decisions when they purchase transportation. Unquestionably, railroad employees are closely identified in the public mind with the company and the industry they represent.

How, then, can we put to favorable use this tremendous public relations force, made up of many individuals? It is not enough for us, as supervisors, to look upon our employees as auxiliary public relations men. The employees must come to look upon themselves as such, and to accept public relations as a function of their jobs. Selling this idea to the employee is a task which must be performed principally by the supervisor, though he should have, of course, the support of the whole management team, right up to the top, in his effort to do so.

Create the Desire

The best way to get a man to do something is first to get him to want to do it. In the case of making public relations men of our employees, we have first to cause them to want to be public relations men.

First, we can share with our men our own knowledge of the conditions which our industry and our respective companies face. We can let them know what the company is up against in the way of competition, operating costs, overhead expense, then explain that getting more customers and winning more friends will help solve these problems.

This knowledge, of course, can't be forced into people's minds; we can't simply take people aside and cram facts into them. But we can keep ourselves up to date on the economics of our industry so that when an opportunity does arise—when a question is asked, when a statement is made—we'll be ready with the true story. Human beings basically are reasonable, and when they can be shown that a certain course of action is to their advantage, they'll follow it. Therefore, we must help our employees understand that what is good for their company is good for them in the long run.

An Essential Community of Interest

The great breakdown in industrial relations—responsible for most of our industrial strife—is the consistent ignoring of the essential community of interest between labor and management in a system which is built to work for both and also for the public at large. Whatever you, in your daily contacts with your men, by your attitudes and your actions, can do to increase the understanding of this point, will be solid, substantial progress toward a better America.

On a long-range basis we must work to instill in our men's minds the idea that public relations is part of their job. When they have accepted this idea, they will realize that their success as railroad men is measured in part by their success in dealing with the public, even though they do not—as in the case of engine crews—normally deal at first hand.

What we are talking about here, essentially, is not making the railroad employee over into something that he wasn't before. Rather we are talking about guiding and assisting him to realize a further potential in the interest of himself and his company. Many railroad men working for you right now are extremely public-relations-conscious. They are keenly aware that their jobs serve the public and depend for their existence on the public's fares and freight payments. You can tell, by talking to these men and observing their work, that they are conscientiously striving to make their railroad popular with the public. They offer proof and encouragement that others can be influenced to feel and act the same way.

A significant step forward in railroad public relations was taken last year when representatives of railway labor unions and representatives of railroad management jointly drafted a "platform" of public relations principles for railroad employees. This declaration affirmed the industry's need for public good will and the advantage to the employee of helping his company attain it. It also detailed ways in which railroad men and women can contribute to better public relations.

As this joint action suggests, there is a clear mutuality of interest between the unions and management in the matter of railroad good will. For any railroad labor union to believe otherwise would be to sabotage the very industry on which its existence depends. That would be about as short-sighted as it would be for a railroad management to refuse to recognize that unions are here to stay.

Employee Relations

In the rapidly increasing use of diesel power you very definitely have problems in the retraining and readjustment of your men. On the technical side, the job may not be too difficult; but, on the psychological side, the new power, like any new idea, has to be merchandised to the people who are going to use it. The reasons for adopting diesels, the tremendous investment involved in them, the hope they hold out for a sounder, more prosperous industry—all these things need explanation if we are to get the maximum cooperation of the men who will actually run the engines.

Years of research and planning, and millions of dollars, are going into dieselization on many of your roads. With them go the hopes of investors, managers, and employees for the future efficiency and soundness of those properties. To a considerable extent, the responsibility for fulfilling those hopes, by successfully accomplishing a major changeover in motive power—in short, by making dieselization work—rests upon your sholders. Your task here, I believe, is basically one of employee relations.

Failures Experienced in Diesel Operation

Two reports were presented on this general subject, one dealing with avoidable delays and the necessity of eliminating them, presented by W. H. Fortney, chief road foreman of engines, New York Central, and the other on how to meet operating difficulties on the road, whether they are avoidable or not. This was presented by W. H. Powell, supervisor of locomotive operation, Baltimore & Ohio.

Mr. Fortney presented 56 cases of complete failures or of delays varying all the way from a few minutes to six hours, gathered from various railroads. All could have been avoided or at least the delays could have been greatly reduced if proper inspection of the locomotives had been made at the terminal or by the crews when they took over, or if the crews had been up on trouble shooting.

Nine of the 56 cases were fuel failures, three because crews either did not know that the emergency cut-out had been tripped, or else did not know how to reset it; three because fuel-pump switches were open and all engines were ultimately killed in checking control fuses. One crew ran out of fuel, and on another locomotive the fireman put water in the fuel tank.

Steam-heat failures is another large group, with six instances described. Three were due to faulty steam-generator operation, two due to admission of steam to the train line too rapidly, causing loss of water, and one to a closed end valve in the train line between locomotive units.

Other classes of failures of which from two to five instances are reported are: engine starting contactors stuck (in some cases causing a complete discharge of the battery before being discovered); failures caused by the operation of ground relays because the crews did not know how to reset the relay; reverse and transition levers in wrong position on one unit, which would have been discovered if an inspection had been made by the crews when they took over; engine cooling system failures—crews were unable to deal with the manual controls of fans and shutters when the automatic controls failed; brake system failures; blown fuses; defective throttle operation, in one case because a bottle of governor oil was left where it blocked the movement of the throttle operating rod; isolation switches in wrong position; control-circuit jumpers loose, and control air pressure low. In most cases the failures or delays were not

caused by the conditions named but by the inability of the crews to find and correct the conditions promptly.

In his report, Mr. Powell described four cases in which difficulties developed on the road and in which prompt and effective action by the crews prevented them from causing delays.

The load ammeter on a locomotive hauling a passenger train at 80 m.p.h. suddenly went to zero and the engineroom became completely silent—all power was off and the steam generator dead. This was diagnosed as an emergency fuel valve tripped. This was reset and no further trouble experienced.

The water line between the engine jacket and the intercooler on a locomotive hauling a freight train split, caused a serious leak. The fireman shut the engine down and at a water stop the road foreman patched the leak with tire tape. No time was lost.

The locomotive hauling a passenger train would not respond to the throttle in the forward unit beyond the third notch. The road foreman operated the power with the throttle in the rear unit on signals from the fireman in the forward cab. The engineman operated the brakes from the front end and there was no time lost.

With a sudden drop in speed of a three-unit locomotive hauling a freight train the circuit breaker in the control circuit operated. With throttle in "idle" the circuit breaker could not be reset. The head brakeman discovered smoke and flame coming from the rear unit. The fireman went back, removed the jumper cable from between the second and third units, did not try to enter the third-unit engine-room, but took to the ground on the right side. In the meantime the engineman has gone back and pulled the emergency fuel shut-off valve. The fireman then entered the cab through a side door, crawled to the battery switch and opened it. Doors were then opened to clear out the smoke and the fire put out in two minutes with extinguishers. The reverser in the rear was blocked in neutral, the dead-engine device set and the run completed with power from the remaining two units.

Discussion

In cases where water is lost from the engine cooling system expansion tank because of inoperative shutters the Baltimore & Ohio can transfer water from the steam generator supply to the cooling system en route. This cannot usually be done on freight locomotives except where they are equipped with steam generators as is the case on the B. & O. To prevent freeze-ups in the air system this road introduces alcohol in predetermined amounts according to temperature on the discharge side of the air compressor. On locomotives where the fans are operated automatically a check of the relays determines whether or not they are operating properly. This check is important in climates where air temperatures are high.

The Frisco does a considerable amount of towing diesel locomotives at some seasons of the year in balancing power and has found that there are nine operations which have to be carried out to condition the locomotives for that kind of movement. The results have been found to be bad if these operations are neglected.

The problems of training men were brought up again in the discussion of these papers, particularly the difficulty of getting the men interested in the material and instructions available for them. One point was stressed that in introducing new men to diesel operation their confidence in their ability to handle these locomotives must be built up. The New York Central endeavors to have their engine crews sufficiently familiar with the diesel locomotive so that they can make up intelligent work reports. The B. & O. has now developed several question and answer books on the diesel. These are used by the firemen in preparation for promotion and are subject to revision from time to time.

In connection with the rules requiring the fireman on passenger trains to remain in the cab with the engineman at all times while the train is in motion, the New York Central has given attention to training the men so that they will have a thorough understanding of the alarm system. This training is said to have been effective in causing suitable action to be taken in emergencies.

One factor in correcting operating difficulties on the road and in keeping maintenance in hand which was mentioned in the discussion was teaching superintendents, trainmasters, yard masters and yard clerks that diesel locomotives must not be overloaded.

Steam-Locomotive Fuel Oil Combustion Studies

Most of the fuels used for motive-power steam generation fall under the grade-six designation of the United States Department of Commerce. These correspond to specifications for Bunker Oils. In general, fuels will range as follows: carbon, 80 to 87 per cent; hydrogen, 12 to 15 per cent; sulfur, 0 to 5 per cent.

Specific gravities will range from .90 to 1.05 or in corresponding A.P.I. gravities from 25 deg. to 3 deg. The heating values will range from 18,250 to 20,000 B.t.u. per pound. Since the percentage of carbon in the fuel in general increases with high specific gravity and since the pounds per gallon of fuel increases in the same direction, the heavier the fuel that can be handled, the higher its heat value per unit volume and the greater efficiency and power load can be obtained from a unit volume of fuel.

There has never been a unified program for perfection and improvement of the oil burner. Each railroad had its own ideas and many obtained successful and economical results. The Texas & Pacific held a leading position in fuel conservation among Class I railroads for many years.

During the latter part of the year 1946, the Southern Pacific began a program of research on combustion, to explore all phases of existing practices and improve the efficiency of their oil burning steam locomotives. Participating in this program were the Southern Pacific's Pacific Lines (Lines West of El Paso), T&NO Lines (Lines East of El Paso), and the Battelle Memorial Institute, a research foundation in Columbus, Ohio.

Engine No. 4401 was selected for these tests because it was representative of the more modern type of locomotive construction on the Southern Pacific. It is a 4-8-4 type locomotive, equipped with feedwater heater, booster, Type E superheater units, front-end throttle, power reverse gear and Walschaert valve gear. It has two simple cylinders with 12-in. piston valves, 30-in. cylinders, and carries a boiler pressure of 250 p.s.i.

No special grade of fuel oil was used in these tests. Oil was taken as needed from the regular supply of fuel oil at whatever location the engine was serviced.

The program was conducted in three major steps, as follows: (1) basic road tests with dynamometer car; (2) standing tests in test plant at Sacramento, Cal.; (3) confirmatory road tests with dynamometer car.

The basic tests were made under actual operating conditions on the road in both freight and passenger service. Several different combinations of oil-burning arrangements, exhaust-nozzle splitters, and smoke-box arrangements were tested. The Battelle Memorial Institute made scale-model tests in the Columbus research laboratories using various data obtained from basic tests, to determine what modifications could be made in existing standards on the locomotive firebox and smoke box, to improve air flow. The basic road tests established operating characteristics of No. 4401 and the data obtained was used to correlate actual operating conditions with standing-test conditions in order to evaluate the results properly.

The standing tests followed the basic road tests. The engine was placed in the test plant especially constructed and instrumented for this research program at the Southern Pacific's Sacramento shops. The standing tests were made with various oil-burning and front-end arrangements. Several types of firepans

and numerous designs of burners were tested, including multiple application of precision-type burners used in stationary boiler service, rotating-cup burners, and various designs and modifications of railroad burners currently used. Burner location and method of air admission were varied to determine optimum performance. The exhaust-nozzle opening was varied; several types of nozzle splitters were tried out. A larger-diameter smoke stack was employed. The information and data obtained led to changes and modifications in existing standards that definitely improved combustion and overall performance.

The final phase of this research program was the confirmatory road tests. Engine No. 4401 was equipped with the improvements developed in the Sacramento standing plant and road tests were made in passenger and freight service under actual operating conditions, similar to the basic road tests. The confirmatory tests proved in actual road service the results obtained in the standing tests.

Improvements developed by this research program include the application of a more efficient gyrojet tubular-type oil burner, better design of firepan, improved drafting arrangement, larger smoke stack and exhaust nozzle, improved firing valve, reduction in heat losses by additional insulation, more effective bricking arrangement, use of top boiler check, removal of obstructions from smokestack, improved oil-tank heater, and better sealing of smokebox. Based on confirmatory road tests made with the locomotive equipped with the above improvements as compared with the basic arrangement, it was found that an overall average fuel saving of eight per cent can be realized with the improved arrangement on the type of locomotive tested.

The nature of this association gives us an excellent opportunity to further similar progress. We must do everything we can as an organization and as individuals to eliminate waste and institute new methods of fuel oil conservation.

The report was presented by T. J. Conway, fuel supervisor, Texas & Pacific.

Discussion

Much of the discussion centered around nozzle tip sizes. While most of it dealt with oil-burning practice, some comment referred to coal. Both the Goodfellow type nozzle and the basket-bridge type have their advocates, the latter being perhaps the more popular of the two. While there was some difference of opinion as to whether nozzle tips on oil-burning locomotives should be larger or smaller than those on coal-burning locomotives of the same size, experience of some roads which have made tests is that only by experimental proportioning of the interrelated dimensions of the front end can the nearest to smokeless combustion and the highest fuel efficiency be attained. In answer to a question, it was brought out that the Great Northern, which began its oil-burning experience in 1911 with all obstructions removed from the smoke box, had obtained improved combustion by restoring the draft plate. Another factor considered of importance in securing efficient combustion and absence of smoke is a tight front end absolutely free of air leaks. Properly aligned burners are also important.

Proper temperature of the oil as it is fed to the burner was stressed as an important factor in producing good combustion. From 150 to 180 deg. was mentioned as being a good practicable working range. On the Great Northern thermometers have been put on the locomotive in some cases as an aid to the fireman.

The Storing and Dispensing of Diesel Fuel Oil

The methods used in the unloading and disbursement of diesel fuel oil are quite generally the same on the railroads checked.

A sample of oil is secured from each car for analysis to be checked with specifications before the oil is pumped from the tank car to the service or storage tank. It is the general consensus that the best practice in handling diesel fuel oil in storage is to unload all tank cars into the storage tank and then fill service tanks, when used in conjunction with storage tanks, or make deliveries from the storage tank. In this manner, the stock is kept moving and in cases where summer and winter grades of diesel fuel oil are purchased, it will permit the transition from one grade to the other. This handling would also eliminate almost entirely any possibility of deterioration of diesel fuel oil that might occur while standing for long periods in storage tanks.

Some unload from the dome while others unload from the bottom valve, depending on how their facilities are equipped. The oil is filtered or screened into and out of storage tanks. Some points also meter in both ways, but the reading into the storage tank is used only for the purpose of determining quantities in the cars as a comparison with quantities invoiced. In all cases of unloading, cars should be thoroughly drained to remove any condensation or foreign matter that may settle in the bottom before they are returned to refineries. They should then be inspected again to make sure that the cars are absolutely clean. They must be inspected frequently to eliminate leaks at bottom outlet connections, and also for leaks around rivets and seams.

Some loss has been encountered due to leakage of underground oil lines running from storage tanks to fueling stations. When a leak develops the loss is considerable before it can definitely be located. The expense involved in correcting it is also quite heavy. This raises the question, should diesel fuel oil lines from storage tanks to fuel racks be underground or above ground, considering the effect of freezing weather.

Frequent inspection of and good housekeeping at diesel oil facilities pays good dividends in fuel conservation. Any leaks must be corrected as soon as discovered.

Cleanliness in the handling of diesel fuel oil must be emphasized and periodic examination of the contents of storage and service tanks should be made in order to determine when these tanks should be cleaned or have sediment and water removed. Water and sediment may be removed by water draw cocks placed in the bottom of tanks, or by siphoning or pumping through pipes placed so as to draw from the bottom. Water can be detected in the tank by the use of cobalt solution which gives a color indication. Diesel fuel oil storage tanks on some roads have been in service for several years without being emptied for cleaning.

It is suggested that additional storage capacity be provided in order to insure an adequate supply of fuel on hand in storage tanks at fueling stations at all times, also to permit prompt unloading and release of tank cars which are in short supply and will, no doubt, continue to be throughout the present emergency. Some railroads are converting residual fuel oil storage tanks, while others will have storage tanks available that have been used as water treating plants no longer required under dieselization.

Fueling the Locomotives

The greatest consideration should be given to fueling of the diesel locomotive to avoid waste that is involved by spillage and overfilling of the fuel tank, for which in most cases it is found that the human element is more responsible than any other condition. Generally, the facilities on the railroads are installed and equipped for the fueling of four units in the one spot of the locomotive, this however does not mean that the flow of oil is made to all units at the same time. The number of units fueled at the same time is largely determined by the number of men doing the work and the capacity of the pumps to supply the oil. One man cannot always control the oil flow to four units without some cases of overflowing the tanks, especially if he is also supplying water to the units in the same operation. For that reason, some points restrict fueling to one or two units at the same time in order to control the high rate of flow by closing the valve at the rack to shut off the pressure in sufficient time to permit as much draining of the hose as possible before the nozzle valve is closed and the hose disconnected.

At intermediate terminals, where passenger and fast freight locomotives are fueled and the "dead time" is short, more units

must be fueled at the same time to avoid excessive delays. Some roads have recommended the use of the automatic nozzle, although some change would be required on the channel between the fueling connection and the tank proper, and on the strainer of some types of locomotives. It has been suggested that consideration be given by diesel locomotive builders to having fuel-oil fill openings installed in fuel tanks with 10 or 15 deg. upward bend, so that supply hoses can be completely drained into the fuel tanks on the locomotive. With the present arrangement, on most passenger and freight road locomotives, it is not possible to drain the supply hoses because the fuel fill openings come straight out of the tank.

Some roads are now testing the Ventalarm signal that whistles until the tank is filled, to eliminate overflow spillage.

No provisions have been made at a number of fueling stations or oil racks to catch the spillage. They are not equipped with trough or cement apron with proper drains to recover the oil for other use, and various types of containers are used in an attempt to catch what oil they can. Some have equipped the riser standards with drip boxes in which the hoses are placed. These boxes are equipped with drain valves in the bottom and the oil is drained out and reused.

Fuel Wasted in Idling

A considerable amount of fuel oil is being consumed by unnecessary idling of diesel locomotives, especially in warm weather when it would be possible to shut them down for sufficient periods of time to warrant it. Tests were made showing that a 600-hp. diesel switch engine consumed 3.75 gallons of oil per hour and a 1,000-hp. diesel switch engine consumed 5.71 gallons per hour idling. Freight and passenger diesels with greater horsepower would use a proportionately larger amount of oil per unit than the switch engines.

As far as fuel statistics are concerned there is a great variation as to the equation factor being used in making comparisons between coal and diesel fuel oil when arriving at unit consumption in pounds per 1,000 gross ton miles (including locomotives and tenders) in road freight service based on equated pounds of all fuel used according to what each road indicates is applicable to its local conditions. As taken from reports March, 1948, for 57 railroads they show a maximum gallons of diesel fuel oil equivalent to one ton of coal of 194.5 in all services and a minimum of 20 gallons in freight service, 16 gallons in passenger service and 12 gallons in switch service.

In freight service the reports show that 12 railroads use between 20 and 30 gallons to one ton of coal; 23 roads, 30 to 40 gallons, 10 roads, over 40 to 50 gallons, and 12 roads, over 50 gallons.

This report was presented by O. D. Teeter, fuel supervisor, Denver & Rio Grande Western.

Discussion

In reply to a question as to whether any effort had been made to standardize conversion equivalents for oil to coal Mr. Teeter said that the Bureau of Railway Economics had prepared statistical reports on unit fuel consumption in terms of each of the three types of fuel in each class of service for 1949 and 1950, which he considered better than equating into terms of coal.

The discussion dealt mainly with the question of how long a locomotive should be allowed to stand at an engine terminal with the engine running. The average cost of diesel fuel in June on the Baltimore & Ohio was quoted as 10.25 cents per gallon and the management is becoming conscious of the need to conserve it. Leakage is another source of considerable loss. At Chillicothe, Ohio, a loss of 20,000 gal. of oil through leaks in underground oil lines has raised the question as to whether the lines should not be placed above ground.

Several rules for idling during stand-by were mentioned. The Missouri Pacific has a one-hour idling rule effective when the weather is not freezing. The Great Northern allows engines to be idled when tied up over night unless there is a source of heat for the cooling water. This prevents water seals from leaking from the contraction and expansion caused by shutting down and starting up. On road power, when it is evident that there is going to be an extensive delay on the road, instructions are to shut down one unit at a time and alternate them. At terminals the engines are operated just long enough to warm them up, say about 30 minutes before they will be used.

The opportunity to keep accurate fuel records on diesel locomotives was stressed. The fuel can be metered and if each outlet has a meter there need be no guess work as to the fuel consumption on each locomotive.

Education of Locomotive Operating Personnel

With the transition from steam to electric and diesel-electric power on the railroads of today, the proper education of locomotive operating personnel assumes a new importance. The conversion brings before each of us the responsibility of changing in a few short months practices that have been in use from the very beginning of the railroads—practices that are more of a liability than an asset in the operation of the modern equipment.

Diesel Instructions

When it is definitely known that diesel power is to replace steam power a course of preliminary instruction should be started immediately. This begins the ground work so the operating personnel will have a true picture of what the new power means to them. To the average locomotive crew the new equipment is mysterious and its operation too complicated to be readily understood. The preliminary classes should accomplish much toward dispelling these ideas.

After the new locomotives arrive and the crews have made several trips under competent instructors they become more interested and the time is now appropriate to set up a permanent program of training and instruction. As the program progresses some inducement is necessary to keep their interest, and the easiest way is to add variety to the classes. The use of visual aids in the form of projection slides and motion pictures of the equipment and its operation can explain more thoroughly in a few minutes than several hours of lecturing.

The most important instruction is that given on the job under actual operating conditions by the supervisors, and it must be uniform in its application to be successful. A common practice prevails that when one group learns their job they pass their knowledge along to another, and if they do their job the wrong way the others following will do the same. A careful check must be kept to see that a uniform standard is maintained.

Selecting New Men

The most important step in the building of a well-trained and efficient personnel is the selection of proper material at the time of employment, as the fireman of today is the engineman of tomorrow. The employing officer should require well supported references as well as make a study of the personality of the applicant to satisfy himself that he is the proper material for employment and—later, for promotion. The employment officer should talk with the applicant to ascertain whether he is seriously considering making railroad work his lifetime career.

The successful applicant should be between the ages of eighteen and twenty-five; should have a high-school education; be of good moral character and willing to study and apply himself. After passing the necessary physical examination he should be given a rule book and timetable, and should be carefully instructed in the duties and responsibilities of his job. He should also be given a preliminary course in Safety First and first aid, and should be impressed with the importance of attending the various classes of instruction in these and other branches of training. He should then be given a permit, after which he should be assigned to one

of the best operating crews on the division for his student trips.

In making the selection of an operating crew for the instruction of a student fireman the road foreman of engines or a supervising officer should choose from among the older members of the service a crew which has not only the knowledge but the ability to impart that knowledge to the students. Many operators who are thoroughly efficient in every particular themselves, lack the ability to impart their knowledge to others. The same rule applies also to the selection of the supervising personnel.

The First Oral Examination

After the student fireman has made his required number of trips and has demonstrated his ability to learn and to apply himself as he should to the crew or crews with which he has ridden, he should be given an oral examination covering what he has been taught, questioned as to his knowledge of the rule book and special instructions, coached in the proper method of flagging the front end of his train when necessary, and instructed as to how to conduct himself so as to prevent personal injury as well as injury to others. He should also be instructed as to the use of supplies and equipment entrusted to his care, and impressed with the fact that he should perform his duties and take an interest in his work, just as though he was working for himself.

Usually he is now marked up on the extra board preferably on a yard engine for awhile. A traveling fireman or road foreman should, if possible, make the first trip or two with him to give him confidence, to see that he gets started off with the right ideas, and to encourage him to look to his engineman for instruction and guidance when confronted with some problem that he does not understand. Some supervising officer should then ride with him once in awhile to see that he does not acquire improper ideas or practices.

The supervisor should know by the time the fireman stands for promotion to engineman just about what kind of an engineman he will make. On our road we do not object to the fireman handling the engine under the supervision of the engineman, although the engineman is held responsible for the fireman's performance. Consequently, most of our young enginemen start running with a fair general idea of their duties and responsibilities. However, unless we know that he is well qualified, we make the first few trips with him, then make an additional trip from time to time to see that he thoroughly understands and carries out his instructions, and handles his engine and train in the proper manner.

We encourage the teaming up of enginemen and firemen who like to work with one another, when seniority rules permit. Our working rules permit assignment of regular men in yard, freight and passenger service, and it is not unusual for an engineman and fireman to stay together on an assignment, even when one or the other stands for a better job.

Teach the Facts of Industrial Life

Years ago the sense of loyalty, gratitude, and pride of position seem to have been a quite general and inherent part of our employees' make-up, but modern political and economic conditions have influenced many people to feel that the country owes them a livelihood. This attitude is destructive, both to the employee and to the employer, and must be nullified by education.

The new man must be thoroughly convinced of his obligation to the railroad and of his responsibilities. He must be impressed with the very large investment made by the railroad stockholders so that he may have the means of earning his livelihood. This feature is too often overlooked. Vigilance and safety must become an ingrained part of the operating employee's mentality. Only a well-directed instruction and a sensible presentation of facts and precedents will create, in many cases, this cooperative interest.

It must be recognized that the welfare of the employee is largely dependent upon the prosperity of the railroad. Economy in the handling of materials and protective care of equipment are indications of an employee's interest. This idea should be incorporated as a part of the educational program.

The diesel locomotive as compared with the steam locomotive requires much less arduous effort and allows more comfort of operation. These facts should tend to further increase a cooperative interest.

The report was presented by G. B. Curtis, road foreman of engines, Richmond, Fredericksburg & Potomac.

Discussion

A series of questions and answers brought out differences in the practices on the R. F. & P. from those on many other roads in the matter of training, examining and promoting firemen. Firemen are not given progressive mechanical examinations, with promotion on passing the third at the end of three years, but are examined in groups in anticipation of the need for promoted men. The examinations are given and judged by the road foreman or his assistant and are both written and oral. The road foreman is entirely responsible for the hiring and promotion of firemen.

There was considerable discussion of methods of training men in the locomotive service in the operation of diesels, but a question as to the preparation of diesel firemen for promotion and as to what kind of mechanical examinations they are given brought out no information. Mr. Curtis said that the next group to be examined on the R. F. & P. would probably be given a diesel examination but it had not yet been formulated.

Questioned as to what methods he used to create some enthusiasm among the men for the study of the diesel locomotive and its operation, Mr. Curtis said that, when they bought a group of road engines, they rented a car and tried to give the men a few fundamentals so they could start and stop the engines. Then followed instruction pamphlets and, with some extra supervision, in about 90 days the men were running diesels. They were taken from 75- to 80-car freight trains and put on diesels hauling 160-car trains. They ran them but were not very efficient. Then, without a car, instruction was continued with a projector and slides and a few parts important in the control of the locomotive. Round table discussions were organized the subjects of which were the problems posed by the men themselves. Those who fail to attend classes or discussion groups are reminded tactfully when they get into trouble and cause a delay that classes are being held, which usually produces favorable results. A record is kept of all delays and these are written up as case studies every two or three months and distributed. They offer opportunity to call attention to men who have done good jobs in emergencies. About the only electrical instructions the men are given is how to check for a fuse failure.

Water Treatment–Steam and Diesel Locomotives

In steam operation the largest single material supply from a tonnage standpoint has been water. The various sources of supply have presented many problems of quantity and quality. Progress from the earliest days of small saturated steam power to the present high pressure superheated power has been a miracle of power evolution. This evolution has demanded and received a similar evolution in water treatment to provide the constantly increasing effectiveness required. This has been met in various ways as our knowledge of water treatment in chemistry grew.

The benefits from water treatment on our various roads have been parallel with the soundness of the fundamental knowledge of water treatment, close supervision and the accuracy of chemical application. These factors apply to diesel power as well as to steam power and will continue to be vital in the future development of any prime source of power requiring the use of water.

Many of our roads are changing from steam to diesel power. This change necessitates a constant revision of steam operating practices. Practices on each road, even each division, must be

constantly reviewed on the basis of its individual power operating conditions.

Water for Diesels

As long as steam power is operated it presents the choice of either efficient or wasteful operation. Some of the points requiring consideration during such power transition periods are maintenance of interest in efficient steam operation during the period when diesel power is being inaugurated, maintenance of high standards of treatment to prolong boiler and flue life, maintenance of clean boiler heating surface to secure efficient fuel performance, closer attention to foaming concentration buildups incident to longer terminal layover periods, increased tendency to sludge and mud accumulations incident to intermittent operation, reduction in frequency of recharging treating plants incident to reduced volume of water consumed and reconsideration of the desirability of using live steam to maintain boiler washout-plant temperature. Each case must be acted upon strictly on the basis of local operating conditions.

In the early days of railroad diesel operation, the manufacturers gave little if any consideration to water treatment. Experience soon exposed this tragic oversight—the three major water problems, corrosion, incrustation and foaming, were exacting a prohibitive toll by overheating of incrusted water cooled parts, corrosion of water surfaces, burned-out generator coils, fuel waste and failures. The manufacturers, chemical companies and railroad watermen searched for the answers. Under the able sub-committee chairmanship of M. A. Hanson, research chemist of the Gulf, Mobile & Ohio, the American Railway Engineering Association Committee 13 developed, compiled and published sound effective standards of treatment for diesel water. This information is available to all. Time tested field operation under such standards of treatment are positive proofs that excessive corrosion of water-contacted metals can be controlled, incrustation can be prevented and foaming eliminated.

Typical of such treatment is the history of steam generators on the first six diesel passenger locomotives purchased by the Frisco. Two failed because of defective coil installation. Four are still in service with the original coils after approximately a million miles of service, including heavy summer operation for steam-activated air conditioning. During the four years coils were de-scaled when excessive pressures indicated need for cleaning. This occurred on an average of only once each seven months for the entire group during the four-year period.

The water engineers and chemists on your respective roads have extensive knowledge of the characteristics of your various water supplies and practical experience in design and operation of proportioning equipment to meet effectively the new problems.

The huge investment by our American railroads in diesel power and the ever increasing standards of dependability demanded of diesel power and steam generators justifies plant control of water treatment on an exact basis if we are to accomplish the savings possible with this type of power. While the volume of water used and the tonnage of chemicals required is small compared with steam-boiler water treatment the cost per pound in many cases is much greater and only by effective plant control can the cost be kept down. Manual application of chemicals for water treatment of diesels is wasteful of chemicals, invites irregularities and requires expensive control and supervisory tests to secure even partial results. To continue extensive manual application means that you are disregarding a major portion of the progress made in perfecting the practical application of water treatment.

You have heard much about preventative maintenance. Its necessity under present operating conditions is admitted by all. Water treatment is the perfect example of real preventative maintenance. Operation of modern steam or diesel power without effective water treatment is economically unsound, if not actually impossible. Good operation is efficient operation. Effective water treatment, or lack of it, can well be the deciding factor in efficient motive power operation.

This paper was presented by I. C. Brown, chief water engineer, St. Louis-San Francisco.

Discussion

In answer to a question Mr. Brown said that the separator is blown down every half hour in the worst water territory and once an hour elsewhere. It is the practice on the Frisco to shut down the steam generator and back flush the coils at each division point. Under the present agreement which requires two men in the cab while the locomotive is in motion, the fireman cannot go back to perform this operation approaching the end of his run and the outgoing fireman cannot do so because the engine is in the station. But it is done at each end of the locomotive run, the longest of which is 541 miles.

Experience on the Burlington is that dependence on individuals for the right kind and right amount of treatment is not satisfactory. Since demineralizing plants have been established at the major water stations the extended life of coils has been considerable. Corrosion took place in the first six turns of the outer coil. The separate economizer coil in the Vapor 4625 plant permits replacement where the corrosion takes place without cutting off and replacing part of the coils as was the practice with former heaters. If the main terminals have treated water Mr. Brown said that the amount of untreated water taken in emergencies was not likely to be enough to cause trouble. It was also brought out that, where a cooling system is known to be leaking, the tank can be filled to the required level with the engine running, which adds 10 or 12 in. of water more than would be taken if the engine were not running. This helps to reduce the amount of water which must be taken at intermediate points during the trip.

In closing, Mr. Brown emphasized the importance of accurate water treatment, which is more than justified by improved performance and reduced maintenance, as well as by economy in the treating materials used.

Steam-Locomotive Coal Economy and Availability

This report pointed out that coal takes in such a range of quality, availability and ultimate efficiency that it is impossible to formulate a purchasing policy other than "the greatest ton-mile production per dollar of fuel expenditure." When commercial demand equals or exceeds the production of the well equipped coal mines it is difficult to purchase the coal desired. When possible, it is good business to encourage the development of coal mines which may benefit the road's traffic and general business conditions along the line.

The availability of a steam locomotive begins at the main shops and continues on through all roundhouses. If it is to be operated efficiently it must be operated with a minimum of delays and failures. To avoid failures strict attention must be given to its mechanical features and to the coal used. Poor steaming locomotives waste fuel and cause failures on the road.

A cold-water method of cooling down locomotive boilers in the roundhouse was described by which roundhouse detentions may be reduced, the life of firebox sheets prolonged and the mileage between tube renewals increased. This needs a cold-water line and a blow-down line and hot well in the engine-house and a cold-water inlet connection on top of the boiler at the front end and a hot-water and steam blow-down connection on or near the dome. The boiler is filled with the injector until it breaks and then the filling is continued through the cold-water line, water being drawn off through the blow-down line. When the boiler is cooled down sufficiently so that the back of the hand can be held comfortably against the firebox sheets the cold water is shut off and the boiler drained through the blow-off cocks. The time required to cool down a boiler by this method after it arrives in the house until it is ready for washing varies

from two and one-half hours for small power to four hours for large power. This method prevents baking scale and mud on tubes and firebox sheets, so that it can be easily washed off. The average life of firebox sheets on the railway employing this method is as follows:

	years
Crown sheets	20 to 25
Tube and door sheets	8 to 12
Side sheets	6 to 10

Drafting and Steaming

The Northern Pacific has eliminated from the front end all possible restrictions to the flow of gases to the stack. This has permitted the area of the nozzle tips on some classes of power to be increased. Instructions are that no changes shall be made to nozzle tips whatever. When a locomotive is reported not steaming it must be taken out of service and the defects found and repaired before it is placed back in service.

To make it possible to burn lignite coal, which tends to expel many sparks, the Cyclone front end was adopted some years ago for all coal-burning locomotives. Although it has given good results, it is now being replaced by the Cannon type as spark arresters need renewal. It works on the same principle as the Cyclone.

Ash Pans

The Northern Pacific has gone to considerable expense during the past few years to prevent sparks from escaping from ash pans. Lignite ash is very fine and will sift through very small openings and any unburned small pieces of coal which shift through the grate will stay in a slow-burning condition for a long time, requiring the ash pans to be kept in the best possible condition. Ash pans with two or more hoppers are being redesigned and one hopper eliminated. Lifting-type hopper doors have been replaced by the radial type and a ⅝-in. iron rod was welded to the inside of the bottom of the hopper walls to make a tight fit when the door is closed.

All pans are tested with water at each locomotive monthly test or whenever sparks are reported escaping from a pan. All fires are investigated and many times are found to have been caused by the engine crew not shaking a small amount of ash down in the pan, then wetting it with water through the swipe pipes, to provide a tight seal, after the pan has been emptied.

Air deflector vanes are installed between the ash pan coping and the boiler leg at both front corners of the pan. These scoop up some air at high speed and prevent syphoning of sparks out of the pan at the front corners. After applying deflector vanes to ash pans, one road reported more uniform combustion over the entire grate area and that it was possible to increase the tip opening area.

Coal

Screening tests indicate that mechanically mined 5-in. by 0, the size long used with stokers, now contains about twice as much ⅜-in. by ¼-in., ¼-in. by ⅛-in., and ⅛-in. by 0 sizes as did this size prior to mechanization. This adversely affects locomotive operation and efficiency. Tests have indicated that a bottom size of ⅜ in. is generally desirable for stokers. Experience has demonstrated that double-screened coal will increase the availability of the locomotive and reduce the cost of handling coal and ashes. One test shows an increase of 7.14 per cent B.t.u. value of 2½-in. by ¼-in. as compared with 2-in. by 0 coal from the same mine, a decrease of about 19 per cent in ash, and that about 1¾ in. is a desirable top size for stoker coal. It would seem to be practicable to specify about a 2-in. by ⅜-in. nut when such a size is readily obtainable. It is preferable if possible to avoid the use of the stoker as a crusher.

This report was presented by C. M. Moddrell, supervisor of fuel and locomotive performance, Northern Pacific.

Train Handling—Joint Session with Air Brake Association

The subjects of train handling, passenger and freight, and dynamic braking have been so thoroughly covered during recent years that any statement or suggestion would be a repetition. Therefore, it was decided to make a study of the methods and practices of train handling employed on the different railroads. Instruction pamphlets from approximately 50 per cent of the Class I railroads were available for our study.

Starting

Generally speaking, the instructions of all railroads are in accord that the engineman of the lead locomotive of a double header should take up all slack and start the train unassisted if possible. With freight trains, speed should be low for a distance of at least 200 ft. to allow slack to be taken moderately on a long train.

Service Braking

The method of handling during service braking is not exactly the same on all railroads when establishing a brake application on a train that is in motion. In freight service, some roads insist that power, or a pulling throttle, must be used. Run-8 throttle position of the diesel locomotive is advocated by some, while others insist on the throttle being reduced to run-3 position. Some advocate a 5- to 7-lb. initial reduction when handling long freight trains while others suggest a 7- to 9-lb. initial reduction. A similar difference in the methods of handling passenger trains exists on different railroads.

First service position—The use of first service position to establish the initial reduction on long freight trains appears to be very popular with most roads, which signifies that all recognize the advantages to be derived from the rate of brake-pipe reduction imposed and the maintaining feature.

Stopping Freight Trains

With one exception, all are in accord that the proper final reduction must be made with a discharge of air at the service exhaust as the stop is completed on a freight train that is being stopped during a forward movement. Likewise, all agree that, when stopping either a freight or passenger train in backward movement, the brake application on the train should be very light, consistent with grade and other conditions. The locomotive brake should not be permitted to apply during the brake application and a light pulling throttle should be used until just as the stop is completed.

Spot stops—Our study of the instruction pamphlets reflects that some roads require spot stops to be made with the locomotive brake alone. Some leave it to the judgment of the engineman, while others prohibit the use of the locomotive brake alone for making spot stops on passenger trains. There appears to be no serious objection to making spot stops with freight trains with the locomotive brake alone, where conditions are favorable for such handling.

Controlling train slack—One railroad does not permit attempting to brake a freight train of 75 cars or more with slack stretched. Apparently, others leave this to the judgment of the engineman.

Stopping Passenger Trains

As a rule, the instructions of all roads provide for the one-application, graduated-release method of stopping passenger trains, with provisions for the two-application stop under certain conditions. Most roads suggest that the stop be completed with light or no brake-cylinder pressure, while one road requires passenger-train stops to be completed with light brake-cylinder pressure on train and locomotive.

Releasing

It appears to be the consensus of opinion that a reduction in brake-pipe pressure of at least 12 lb. should be made on a freight train of 75 cars before a release is made and that two minutes should be allowed for brakes to release before attempting to start. Most all are in accord that graduated release on passenger trains should not be made if the total brake-pipe reduction is not at least 10 lb.

Brakes Applied by Other Than the Engineman

With one exception, all roads require the throttle to be closed and automatic brake valve placed in lap position immediately when train brakes are applied in emergency. The instructions of one road provide for the brake valve to be left in running position during the stop of an emergency application. Also, there is a radical difference in the instructions for handling when train brakes are applied in a service application by other than the engineman. The instructions of some roads provide for the brake valve to be left in running position, throttle to be gradually reduced as train speed reduces, and when approximately 100 ft. from stopping point the throttle is to be closed and locomotive brake fully applied. To place the brake valve in lap or service position would probably cause brakes to apply in emergency, according to their views. The contrast is the road that requires the throttle to be reduced to a light pulling position as soon as the brake application is observed, to fully close the throttle and apply locomotive brake 500 ft. in advance of the stopping point, and when within 200 ft. of the stop, brake valve is to be placed in service position and left there until stop is completed.

The radical differences in the instructions are sufficient to invite a discussion of the subject.

Dynamic Braking

It has been proved that a tremendous saving in wheel and brake-shoe wear can be effected by the proper use of the dynamic brake. Our study indicates that very few roads use the dynamic brake in freight service and all those using this brake for controlling train speed in freight service do not make use of it for controlling speed of their passenger trains. It has been stated that the dynamic brake has many possibilities. The writer is in accord with that statement.

Respectfully submitted for your consideration and with the hope that during your discussions something will be said that will contribute to the program for improved and better train handling.

This survey was presented by T. H. Bickerstaff, general supervisor of air brakes, Atchison, Topeka & Santa Fe.

Discussion

This survey was presented by T. H. Bickerstaff, general supervisor of air brakes, Atchison, Topeka & Santa Fe.
the rear end of the train in effect on the M.-K.-T. and other roads, it was explained, originated as the result of tests conducted on the New York, New Haven & Hartford about 1923. It was found in these tests that under certain profile conditions, lapping the brake valve produced undesired emergency brake applications which frequently caused break-in-twos. It was also evident that, in handling long freight trains, lighter initial brake-pipe reductions than are mentioned in the report are considered necessary by a number of roads and that subsequent reductions should also be of the order of 3 or 4 lb., a result accomplished by the first service position of the brake value. Examples of successfully handling trains of more than 150 cars by this method, including the use of the slack-stretching throttle, were cited.

The Frisco, on the other hand, limits the use of the stretching throttle to trains of 75 cars and less. On longer trains this road found that, with three-unit diesels, it was impossible to keep the train stretched because of the brake-pipe pressure gradient. The practice is to close the throttle, allow time for the slack to run in, then make a light initial brake-pipe reduction and increase the application in light steps up to the amount which can be released without stopping the train or tearing it in two at the final speed desired. In releasing the brakes on a long train with bunched slack the practice is to apply the independent brake to not less than 20 lb. before releasing the automatic brake and keep it on until the train brakes have released. Then it can be released gradually in 4- or 5-lb. steps. Further time should be allowed for slack adjustment before using power again.

The question was raised as to what happens to a train when braking with a full throttle if a bad triple valve or a bad feed valve should cause an undesired emergency. The only answer volunteered was that there are few triple valves left and that the AB brake is relatively free from undesired emergencies. It is the opinion of those who favor the use of the stretching throttle that most emergencies associated with break-in-twos and reported as "undesired" are the result of break-in-twos and not their cause; that the cause is a reversal of the slack in the train.

Cases of undesired emergency not accompanied by break-in-twos were cited on two roads. One has the emergency application on releasing the brakes after several applications have been made going down grade with the locomotive throttle in idling position. This also happens on the first application after the use of the dynamic brake and on both passenger and freight trains. No explanation has yet been found. Inadequate compressor capacity was suggested as a possible cause in the case of passenger trains. The other road has trouble when starting long freight trains after a stop. The emergency occurs whether the start is ahead or backward to take slack. This seems to be associated with cars on which vibrators have been used in unloading.

The Great Northern has made several tests of stopping trains from the rear end. With a train of mixed empties and loads the first test was made lapping the brake valve and gradually easing off the throttle. Two knuckles were broken. In the second test the brake valve was left in running position and the throttle handled as before. Three trial stops were perfect; on the fourth one knuckle was broken in the middle of the train. Tests were also made on ore trains, hauled by Mallet locomotives, which have 100 per cent AB brakes. On a train of empties with the brake valve in running position a knuckle was broken on the tenth car back. With the brake valve lapped trial after trial was made with no failures. With loads, running from 18,500 to over 19,000 tons per train, the train broke in two when stopping with the brake valve in running position. Since using the A1 caboose valve in the No. 2 position, and lapping the brake valve, there have been no break-in-twos.

In defense of enginemen and road foremen, who catch much of the blame for less than perfect brake performance, attention was called to a failure of management to change signal spacings to compensate for the slow brake application using the first service position of the brake valve, and to provide sidings with 30-m.p.h. instead of 15-m.p.h. turnouts. Both are critical factors in handling long freight trains with freedom from damage.

* * *

Checking wheels of the Southern Pacific streamliner "Shasta Daylight" during nightly inspection. Magnifying mirror gives enlarged view of any tread or flange defects which may be discovered

Car Men Hold Record Annual Meeting

Three-day sessions at Chicago emphasize the need for better lubrication and general car maintenance

J. A. Deppe, President
(Superintendent car department, C.M.St.P.&P.)

W. N. Messimer, Vice-President
(General superintendent equipment, Merchants Despatch Transportation Corp.)

F. H. Stremmel, Sec.-Treas.
(Assistant to secretary, Mech. Div., A. A. R.)

FROM the point of view of attendance, quality of committee reports, discussion and addresses by leading railway executives, the three-day annual meeting of the Car Department Officers' Association at Chicago on September 17 to 19 was a record breaker At least 450 members and guests were present at the first session when President J. A. Deppe, superintendent car department, C.M.St. P.&P. delivered his opening address.

Speakers at the various meetings included J. P. Kiley, president of the Milwaukee; G. J. Willingham, director of personnel, Illinois Central; and A. L. Green, special representative, Freight Claim Division, A.A.R. The association was also addressed informally by F. K. Mitchell, manager of equipment, N.Y.C., New York and F. T. James, general superintendent motive power and equipment, D.L.&W., Scranton, Pa.

Committee reports were presented on Wheel Shop Practices, Chairman E. E. Packard, district master car builder, S. P., Los Angeles, Cal.; A.A.R. Loading Rules, Chairman A. C. Bender, joint supervisor of car inspection, Cleveland Car Inspection Association; A.A.R. Interchange and Billing Rules, Chairman J. J. Sheehan, supervisor car repair bills, M. P., St. Louis, Mo.; Air Conditioning, Chairman R. F. Dougherty, general electrical and air conditioning inspector, U.P., Omaha, Neb.; Analysis of Train Yard Operations, Chairman W. B. Medill, master car repairer, S.P., Portland, Ore.; Car Lubrication, Chairman K. H. Carpenter, superintendent car department, D.L.&W., Scranton, Pa.; Preparing Cars for Higher Commodity Classification, Chairman T. E. Hart, chief car inspector, N.Y.C.&St.L., Cleveland, Ohio; Testing Passenger Car Cleaning and Painting Materials, Chairman E. M. Driscoll, foreman painter, C.M.St.P.&P., Milwaukee, Wis.

Address by J. P. Kiley

J. P. Kiley, president, C.M.St.P.&P. paid tribute to car department forces and said that, although railway men in many departments contribute to train operation, rolling stock would not be on the rails at all without car men who are now faced more than ever before with the urgent need to find better ways of doing things.

He mentioned the intense competition confronting the railroads today and said that major efforts to give industry constantly improved freight service and passengers ever more speed, comfort and convenience must not be allowed to slacken, even if some railroad problems might be simplified thereby. For example, present hot-box difficulties are, no doubt, partially due to stepped-up speeds in freight service, and speed reduction would, of course, help reduce hot boxes, but this solution would be an admission of defeat and unthinkable to any red-blooded railroad man. Mr. Kiley remarked that, but for the efforts of conscientious car men, railroads would have even more hot boxes to deal with than at present, and yet these men, by more intensive servicing of plain-bearing journals, or other appropriate means, must do their full share to minimize hot boxes, now causing so many train delays, disrupted freight schedules and attendant costs.

Mr. Kiley mentioned the problems of car men in servicing and maintaining complex modern passenger cars, including air-conditioning equipment, which the public likes and hence must be kept functioning properly. He suggested that car supervisors continue their good work in maintaining car conditions which will minimize loss and damage claims, and closed his remarks with an earnest appeal for all car men to assist in railway public relations work whenever and wherever possible in their contact with shippers and the general public.

A. A. R. Loading Rules

The committee believes that most difficulties with open-top loads is not entirely the fault of current loading rules being inadequate, but more due to mishandling of the equipment in hump, switching, and train service. This results in delay to shipments, unnecessary expense to carriers for damage and adjustments of loads, not to mention dissatisfied shippers and receivers of freight with resultant loss of traffic to competitive modes of transportation.

Therefore, car supervisors should appeal to their operating departments to obtain cooperation by improved handling of open-top loads.

The committee continues to receive reports of violations of loading rule requirements on open top lumber loading occurring in the southern and southeastern part of the country. Examples of some of this improper loading from these areas are illustrated.

The most serious and disturbing subject before our committee was the trouble encountered with loads of Farm Machinery and Agricultural Implements as per Figs. 171, 172-A, 172-B, and 172-C. In some of these cases the loads fell off the cars when in transit.

Much difficulty is being experienced due to wires breaking at the point of securement to the commodity itself, account of contacting sharp edges of corners, due to vertical oscillation and the omission of protecting plates.

The committee has experienced several cases where farm machinery has fallen off cars due to wire breakage and numerous load shifting, account improper tie down and insufficient securement. Machines fall off cars; wires to the machines contact sharp edges or corners without protection plates; also 4 in. chock blocks.

Tractor Loads Continue to Fail

Due to the continuance of failures of tractor loading as per above mentioned figures and which failures are due to loose twist in hold down wires, causing slack in these wires, the contention is that current loading rules are not adequate for present day longer and faster trains.

We recommend that the ends of wires should be securely tied together and when strands are twisted the twist should be locked to prevent wires loosening, which we definitely feel is to a large extent responsible for breakage of wires and resultant disarrangement of loads.

Fig. 171, Item B—We recommend that alternate blocking per Sketch No. 2 be deleted.

Reason—Committee feels 4 in. block is inadequate, basing contention on trouble encountered.

Wrought iron pipe loading as per Fig. 80 to 84, inclusive, should be carefully inspected at originating point to determine that all loading details required have been complied with. As the length of the pipe and the height of the load above sides of car determine the number of bands or wires and stakes required, inspectors should check these details.

Of equal importance, inspectors at intermediate terminals and interchange points should be alerted to detect any broken bands, wires, stakes, or shifting of the load in transit.

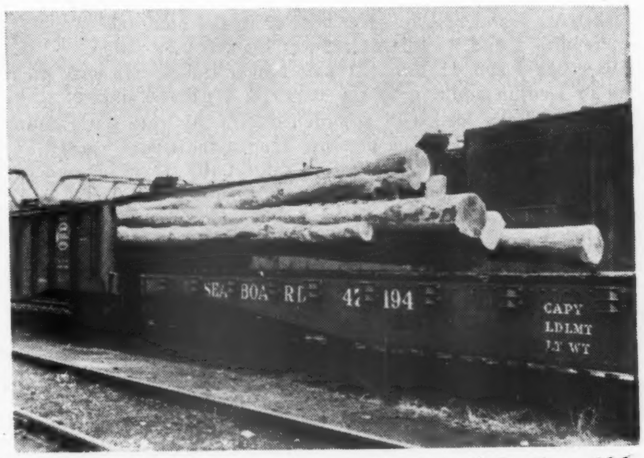
Shippers of pipe should become familiar with General Rule No. 4 to avoid possible concentrated over-loading of fixed end gondola cars with short length small diameter pipe placed in center of the car. This can often be avoided by proper spacing of the outside bearing pieces on floor of car.

The indications are that the shipments of large diameter steel pipe for the so-called "Big-Inch" pipe lines will increase and continue for many months and efforts should not be relaxed to safely move this large tonnage to its destinations.

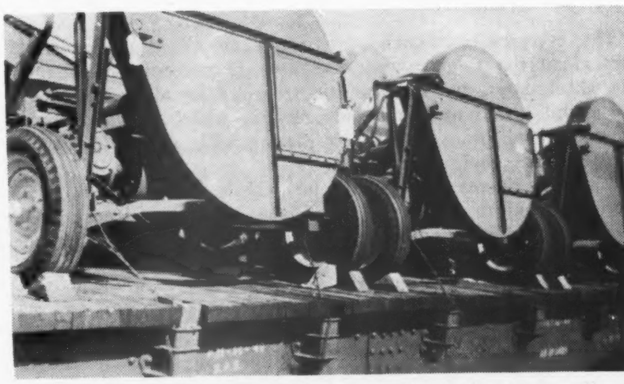
Loading Rule No. 5—Gondola Cars—Observations have been made which show violations of the requirements that load must be secured to prevent "moving or tipping towards sides of car". It is important in this connection that inspectors and shippers be familiar with the 8-in. and 18-in. limits of vacant space across car that requires sidewise blocking of the load.

Figs. 6 & 7, Item D—Recommend an addition to this item to read, "Lumber 1-in. and less in thickness to have 4 separators equally spaced on pile 12-feet to 24-feet long and 5 separators on pile over 24-feet long to 40-feet long."

Reason—Separators on 90 per cent of the loads, loaded in accordance with this figure, are two or more inches thick, permitting thin lumber to sag considerably between the separators.



Permissible length of overhang poles exceeded, also width. Bearing piece between body bolster and end sill. Load shifted



Farm equipment improperly loaded with blocks too small and wire hold downs failed causing one of these tractors to become loose and fall off the car

Load shifted through 2-in. by 6-in. side stakes. Cross braces outside of stakes. Stake ties too long. Longitudinal ties wrong and omitted

This allows a bouncing action to set up in road haul, resulting in badly shifted loads. Additional separators would make a more firm load and prevent much shifting of thin lumber.

Fig. 6, Item G—Recommend eliminating (d) under this item.

Reason—Have found that lumber over 24-feet in length, which had been banded by the shippers, shifted less than that which was not banded or wired as permitted by the present rule.

Fig. 27, Item B—Recommend the following revisions in this item:

Sketches 1 and 2: Pile 7-feet high or less, 4 pair stakes.

Sketches 1 and 2: Pile over 7-feet high, 5 pair stakes.

Sketches 3 and 4: Two (2) pair binder stakes, one near each end of load in addition to the required 4 pair of stakes.

Reason—Poles loaded in accordance with this rule settle down out against the stake. The pressure against the stakes, caused by out against the stake. The pressure against the stakes, caused by the spread load, results in broken stakes, which causes the railroads much trouble. Believe an additional pair of stakes on Sketches 1 and 2 and two pairs of binder stakes on Sketches 3 and 4 will correct much of this difficulty.

Proposal—Unpeeled pulp wood—Recommend that a figure or method be incorporated in the Forest Product Pamphlet on the loading for safe movement of unpeeled pulp wood.

Reason—Much unpeeled pulp wood is being hauled in symbol trains and roads, which Members of this Committee represent, are experiencing difficulty with shipments of same.

Shooks or Knocked Down Crates—Recommend that figure be incorporated in Forest Product Pamphlet to cover loading of shooks or knocked down crates; also consideration be given to package loading of this lading, as illustrated in attached photos. (Photos not reproduced—to be referred to A.A.R. Committee on Loading Rules).

Reason—Current rules do not contain figure or specification to govern this type of lading.

Rule No. 10—Proposed by the committee that under heading of Rule No. 10, an understandable method for tying wires be shown; also that a method of tying that will eliminate slack be developed.

Reason—No method outlined as to how ends of wires be tied.

Recommendation—That counting of strands of wire be at the turning point of securement.

Reason—Actual critical point of pull load is at turning point of securement.

Ingot Molds—Recommend that consideration be given to adopt figure and specification to cover the loading of this particular commodity, which is not now covered by rules.

Reason—There being no figure to cover, ingot molds are being loaded in many instances without use of blocking and 18" of crosswise vacant space is excessive. Recommend that maximum crosswise vacant space be 8" without blocking.

(The report was presented by Chairman A. C. Bender, joint supervisor of car inspection of the Cleveland Car Inspection Association).

Wheel Shop Practices

The evergrowing demand for wheels on all of the railroads throughout the country places an ever greater responsibility on the wheel shops, and has made it necessary for all roads to purchase and install new and more modern wheel shop equipment such as wheel lathes, axel lathes, boring mills and various types of Magnaflux equipment.

With this increasing demand for wheels, it is the desire of every mechanical officer and wheel shop foreman to completely revamp his wheel shop by relocating his machines in more advantageous positions, install conveyor delivery devices for moving the wheels and axles through the shops, and in general change the set up so that the work can progress through the shop in a more uniform manner, with a minimum amount of handling, and come out at the finish location ready for shipping or local application. One suggested shop arrangement is as follows:

1. Shop so arranged that either new or second hand axles can be moved on a conveyor from the demounting press in the following sequence:
   (a) Through the sand blast or other type of cleaning.
   (b) Through the recentering machine.
   (c) To the axle lathe for conditioning journals and turning wheel seats to step sizes.
   (d) Through the magnaflux machine.
   (e) Through burnishing machine for journal polishing.
   (f) Thence to axle storage racks ready for mounting.
2. Sufficient number of wheel boring machines to properly and quickly bore the required number of wheels. These machines to be of adequate horsepower and speed to permit the use of carbide tools. Wheels to be bored to step sizes in order to omit the "miking" of individual wheel fits.
3. A demounting wheel press of capacity to quickly dismount both wheels at once.
   (a) Means to quickly dispose of scrap wheels, preferably directly into a scrap car from disposal chute located at the press.
4. A mounting wheel press arranged to press on both wheels without turning wheels end for end.
   (a) An axle rack in connection with the mounting wheel press with suitable jigs so that wheels can be premounted on the axles by hand and quickly rolled into the mounting press.
5. Wheel lathes of sufficient power and speed to quickly and accurately turn mounted steel wheels, using carbide tools if machine is of proper design.
   (a) Means to load wheels into the lathe quickly and safely.
6. Modern mounted wheel journal lathe, end driven, on which rough journals can be turned with carbide tools and journals rolled with opposed burnishing rolls, insuring proper finish of the journals.
   (a) This machine to be equipped with mechanism to quickly and safely replace the wheels into the lathe for turning and subsequent remounting.
7. A modern, end driven journal burnishing lathe for burnishing the journals on dismounted axles, this machine using opposed burnishing rolls. The controls for this machine should be activated by hydraulic pressure to relieve fatigue encountered by the operator.
   (a) Means to quickly and safely load dismounted axles into this machine.
8. A modern Magnaflux machine using "black light" for the inspection of dismounted axles, with suitable connections for the power source so that mounted journals can be magnafluxed with the powder method.
   (a) Means for quickly and safely loading axles into the Magnaflux machine.

Many wheel shops throughout the country are still working with old antiquated machines and equipment that have many years ago served their usefulness and should be retired and replaced with new, modern, high speed, up to date equipment.

It is highly desirable, and in the end more profitable, to retire these obsolete and worn out machines and replace them with equipment that will produce two to three times more and which, over a comparative short period of time, will more than pay for themselves in labor and in production. This fact is proven every day in modern industries. Our builders of automotive equipment are not trying to build 1951 automobiles with 1920 equipment. The builders of diesel locomotives are not trying to build present day diesels with twenty and thirty year old machinery and equipment. Every phase of modern industry is highly streamlined to the point where lost motion and slack do not fit in and with conditions as they are and have existed for the past decade or more, such methods of operation are not only a requirement but also a necessity.

Many railroads are now working to this end in their wheel

shops, and in so doing are finding it possible to centralize wheel and axle work and by doing so are getting a better class of work, greater production and realizing savings in the over all job. One or two strategically located, well equipped and modernly fitted wheel shops will readily displace a dozen wheel shops equipped with old and worn out equipment, from which only a minimum of production is being obtained, and in which, in most instances, for many and varied reasons, bad wheel shop practices have crept in. It takes as many men to turn five or six pairs of wheels in eight hours on an old wheel lathe as it does to turn twelve to fourteen pairs of wheels on a modern, high speed lathe, using carbide tools. Similar comparison can be made between any old and new machines throughout the wheel shops. Therefore, the ultimate goal which is being sought today by all mechanical departments is to streamline their wheel shops, throw out lost motion and get the full measure of production that we know is possible.

[The report here went into details regarding wear limits for multiple-wear steel wheels, carbide-tip tools, one-wear steel wheels, A.A.R. rules, gauges, etc. The report was presented by Chairman E. E. Packard, district master car repairer, Southern Pacific, Los Angeles, Calif.—EDITOR.]

Discussion

A question was raised regarding the best method of cleaning car axles prior to magnaflux testing and the answer was, "Sand or shot blasting," which, however, cannot normally be done while axles are being progressed through the wheel shop. No suggestion for this particular operation was advanced.

W. D. Nelson, shop superintendent, L. & N., Louisville, Ky., who raised this question, said that he finds only from 4 to 6 per cent of axles Magnafluxed defective and then rarely at the center.

W. N. Messimer, first vice-president of the C. D. O. A. and general superintendent of equipment, Merchants Despatch Transportation Corporation, Chicago, asked how many railroads are equipped to turn one-wear steel wheels and thus get credit for applying wheels to foreign cars. The answer was "not many" and the practice is largely a waste of time.

Car Lubrication

There has been a change in oil and waste specifications since our last meeting and they should be given a fair trial in service. In theory they should produce a better operation and we hope that actual service will so indicate, however, results to date are disappointing.

To give these materials a fair trial we must provide a better job, one of which better workmanship will be of prime importance. There seems to be a persistent trend away from good workmanship and strict compliance of Rule 66, from the preparation of the packing to its final application in the journal box; as well as other conditions which have to do with the prepared packing performing properly.

We have found in great numbers, the following violations of Rule 66 and unless we correct them, very little progress can be expected:

1. Waste does not meet present specifications.
2. Oil does not meet present specifications.
3. Waste is not saturated as per A.A.R. rules.
4. Packing is not transported in proper containers.
5. Oil is not drawn from bottom of vat or container and poured over packing, or packing is not turned as provided.
6. Journal boxes are not properly cleaned before packing is applied.
7. Packing is not applied in one piece if this method is used; rolls are undersize or oversize if this method is used. These cause either under or overpacked boxes.
8. Defective journal bearings and wedges are not removed.
9. Missing and defective journal box lids are not replaced.

There are others but these are the main ones. All are violations of mandatory A.A.R. regulations and rules, and it is up to us as carmen to correct.

Our past requests for a better oil and waste have created some changes and we must insist on a strict compliance of Rule 66, so that full benefit can be derived from them.

Your Committee held a meeting here last April and these were some of the subjects handled—

1. Since greater use of waste retainer, not enough packing is applied.
2. Not enough packing; underpacked boxes seem to predominate.
3. Management still does not allow sufficient time to service-treat boxes in train yards.
4. Rough handling and heavy switching of cars just prior to dispatchment.
5. Oilers and Box Packers are not provided with up-to-date tools or facilities.
6. Train yard supervision not capable of properly educating and supervising oilers.
7. Department foremen, general foremen, general car inspectors and other car department supervision sometimes fail to supervise the second and third shifts of yard employes to the same extent that the first shift of employes is followed up.
8. Too much direct criticism for hot boxes instead of an analytical educational program of prevention.
9. Something ought to be done in providing oilers and box packers, who must work nights, with decent lights so they can perform their work properly.
10. Two of the members proposed a Slow Order for 10 miles of 20 to 25 miles per hour, which would allow the oil to start lubricating before high speeds were obtained, this being more advantageous in real cold weather.
11. Shop system equipment at 9 months for repacking.
12. Wood dust guard plugs, if used, must be held by a retainer, otherwise they are of little value.
13. Handling of spring packing retainer in real cold weather when packing is stiff.
14. When spring packing retainers are used they must be removed every 60 days, at which time the packing must be loosened up and leveled off before reapplication.
15. Better maintenance of journal boxes, failure to maintain lid lugs in proper condition is the cause of losing thousands of lids, plus the failure to protect packing from dirt and moisture.
16. Passenger equipment with roller bearing boxes must have oil levels checked at intervals often enough to eliminate the possible lack of oil.
17. Use wear plates and bushings on lid hinge lugs of all new side truck frames.

Persistent rumors, and in some cases backed by facts, would indicate some few are packing journal boxes with little more effort other than changing stencils. These conditions, when known, should be handled immediately for correction.

We wish to elaborate somewhat on Mr. Nelson's report to Mr. Hawthorne, under date of February 26, 1951. All of you probably have a copy of it or some parts of it.

One hundred thirteen samples from a total of 132 samples of packing failed to meet A.A.R. specifications. 13,500 cars in shops and about 116,800 empty cars in yards having journal boxes overdue for periodic attention were forwarded in service without having this work performed.

How can we expect an improvement in hot box performance, when we persist in allowing such conditions to exist, especially when we have the authority and the duty to correct.

We are supposed to be getting better materials to control hot boxes. We have been griping for years that we were unable to control hot boxes because the materials furnished for this work were inadequate for proper control. If better grade materials are now available, we should be able to do a better job.

Information in connection with magnetic particle testing indi-

MAGNETIC PARTICLE TESTING OF PLAIN BEARING CAR AXLES — 1949

Railroad	Number of axles tested	Number of axles tested crack on journal	Cracked journal OK after turn and test (salv.)	Number of axles scrapped crack on journal
B. & O.	27,101	208	163	45
B. & M.	232	...	...	...
Burlington	43,151	293	164	153
C. & E. I.	4,205	14	no record	14
C. & N. W.	20,756	220	70	150
D. & R. G.	5,111	154	71	83
D. L. & W. (6 mons.)	4,102	27	8	19
Frisco	6,312	635	622	13
I. C.	4,864	306	283	23
L. & N.	10,856	41	0	41
Milwaukee	22,902	80	8	72
Mo. Pac.	9,720	66	0	66
M. K. T. (9 mons.)	999	11	0	11
Nor. Pac.	26,702	255	74	181
New Haven	8,842	14	...	14
N. & W.	3,667	4	0	4
N. Y. C.	23,953	307	record incomplete	
Penna. (mounted)	64,438	737	...	737
Penna. (dismtd.)	37,101	169	...	169
Reading (6 mos.)	3,685	18	...	18
Santa Fe	24,017	272	103	169
SLSW Cottonbelt	11,600	8	...	8
Erie	17,420	209	...	209
Total	381,736	4,048	1,558	2,199
Percentage		1.05	.4	.57

cates the many potential hot boxes and failure had this operation not been performed. It also indicates the many cracks in journals which, no doubt, were the result of previous overheatings.

Much information seems to be packed in these figures: A—about 1 per cent of axles tested show cracks on journals. B—about .6 per cent axles tested were scrapped acct. cracks on journals. C—about half the axles showing cracks were salvaged.

It is understood this is a generalization, as all roads do not test in the same manner, neither are all the reported figures consistent. The wide variation between railroads as to number of cracked journals found indicates the need to carefully re-examine methods of tests and procedure.

Hot boxes are on the increase. Many reasons have been advanced as the cause. All of us have some particular item if changed, improved, added, etc., would solve the problem, but your committee is of the opinion real future progress must come from research of the entire subject.

It is a well known saying that: "When scientific theory differs with practice—the technical man questions the practice, the practical man discounts the theory."

It is possible future research should be provided by an unbiased organization with the qualifications to study lubrication, operation, service, engineering and all related parts.

The A.A.R. has made efforts to improve the oil and still not increase the cost. This is done by "additives" to increase the viscosity index and reduce the "pour point." Additives used to help an otherwise poor lubricating oil to meet a specification probably will not meet the needs. Residual oils blended with distillate oils to reduce the price of oils and throwing in some additives, is not meeting the desire for better lubricants.

Capillarity or oil travel of residual oils in waste is low. The greatest number of hot boxes occur in summer when capillarity or oil travel should be ample to keep the journal cool.

High Film Strength Required

The oil should have a high film strength to meet the needs of fast acceleration and deceleration. The basic quality of film strength has been proven by the A.A.R. Laboratory in their Fifth Progress Report. This report also indicates the value of car oils free of residual, where reclaimed motor oil performed so satisfactorily.

A.A.R. Specification packing allows 50 per cent slasher or sized threads when machined. Cotton warp threads are straight cotton. Slasher is the same thread with a sizing of starch or similar material to the extent of 10 per cent of the weight of thread. Sizing decreases capillarity or oil travel in the threads. Machining is stated as removing this sizing. It does, but only slightly. Why argue about 0.1 per cent impurity in the oil and allow 10 per cent impurity in the waste? Tests show oil travel in new packing containing 50 per cent slasher is good. This is new packing and dry reclaimed oil. What happens when water enters the box? What happens to the sizing in the waste? This creates soggy packing and future trouble. Repacking boxes more frequently gives fresh threads to carry oil, but frequent packing is not the answer to correct other basic faults.

The bronze bearing with a babbitt lining is a plastic material—it deforms under impact. The lack of proper bond of babbitt to the back has caused many failures. Oil seepage between lining and back adds to the dam of heat. A check shows a large percentage of bearings removed from service probably because the bond between the lining and the bearing back could not withstand the service. A bond of greater strength seems desirable.

Copper Penetration of Steel

The great important fact is the effect of the bronze bearing on the axle journal when a hot box develops, the babbitt is sweated out, and the weight of the car brings the bronze bearing on the journal. This is the forerunner of a burned off journal. The copper penetrates the steel. It took a long time to convince some people this was the cause of journals breaking off due to overheating. When the copper penetrates the steel journal, a crack develops about two-thirds the distance from the axle collar to the fillet. This is where the concentration of the bearing gives the greatest heat of friction. Sometimes the journal does not "Burn Off" but develops a crack. A second period of service and this crack is a failure, not readily possible of evaluation as caused by the first hot journal or at the time of failure. Sometimes the crack develops a fatigue fracture after the first hot box; this then is definitely due to the first hot box.

Is it generally understood that 1 per cent of the axles that go through a wheel shop have cracks in the journal due to copper penetration from a previous hot box?

Is it generally known that the figures of the I. C. C. show that the losses due to derailments are mounting from this cause of burned off journals and has now reached the figure of millions?

The cost figures include loss of equipment, damage to right of way, and wrecking expense only, and does not include damage to lading or damages to injured. Reports do not include failures when damage is under $275.

Let us have an unbiased research study made of the subject. Let us make the improvement and changes that are necessary—not influenced by data only half assembled and opinions that are passed as facts.

There can be improvements in all phases of the subjects that are connected with lubrication of cars—any one will not cure the trouble. But if we allow the facts and figures of the poor operation to guide our judgment, we will improve all conditions and have far better operation at a saving of money.

It appears at this time, some A.A.R. specification oil lacks the ability to properly lubricate journals under conditions prevailing during the warm summer months.

(The report was presented by K. H. Carpenter, chairman, superintendent car department, D. L. & W.)

Discussion

J. J. Laudig, research engineer, D. L. & W., Scranton, Pa., said the finish on the inside collar of the axles should be the same on the fillet. He liked the idea of better car oils and said that proper additive in clean oil "does the trick."

A member from the Pennsylvania said that with spring retainers in general use journal box packing should be packed to the center line instead of one inch below to assure its not dropping away from the journal and causing a lubrication failure. He said these retainers should be removed for inspection every 60 days and train speeds limited to 15 m.p.h. for a short time before getting to maximum speed.

W. J. O'Brien, general car foreman, N. Y. C. & St. L., Chicago.

LOSSES DUE TO JOURNALS BROKEN, OVERHEATING

Year	Bul. No.	Total number accidents	Derailments	Injured	Total reported damage
1947	116	509	421	2	$1,618,059.00
1948	117	481	411	8	1,754,593.00
1949	118	420	371	19	2,292,062.00
1950	119	571	491	30	2,701,809.00

suggested a joint committee with operating men to get some action on rough handling.

F. K. Mitchell, manager of equipment, N. Y. C., New York, said that in the absence of other changes except in oil, he believes the recent change in A.A.R. oil specifications is a mistake and the N. Y. C. is now using another type of oil with additive. He referred to a joint committee already set up with the Transportation Division and said that the change from plain to roller bearings is on the way but cannot and should not be too quick. In the meantime better results must be secured with present details.

F. T. James, superintendent motive power and car equipment, D. L. & W., Scranton, said that three alibis are usually offered for all hot boxes: box damaged; waste grab; or poor workmanship. He also doubted if the new oil specimens are entirely satisfactory and called attention to the influence of heavy load on hot boxes which seldom occur on empty cars.

John Carver, mechanical and research engineer, I. C., Chicago, referred to themo checking in train yards; distorted journal bearings, due to humping cars; better and stronger bearings; and oil with more "guts" for heavier loads and speeds.

Refinishing Passenger Equipment

It was decided this year to show, in some technical detail, the cooperation between the paint department and the engineer of tests. From the practical side, tests are often made by the paint foreman doing a job to be tested in actual service. In this manner he can tell how the material handles both by brush and spray application, and also determine hiding qualities, flow-out, coverage and general performance, which is so essential to proper finishing. Then following through the various phases over a period of time he can check as to durability, etc.

This practical test is of great value but suppose the material does not work out satisfactorily? In that case time and money are lost by both the railroad and the manufacturer. This would require a new batch of material and another test. So, when a new product is desired or some manufacturer is allowed a chance for approval on an item, generally, the engineer of tests first receives a small sample to examine the contents by laboratory tests and to determine, as well as is possible, that the product is just about what is required and approves or disapproves it from a technical standpoint.

In line with this procedure we have invited a laboratory or technical man to join us and explain just what methods are used to determine the suitability of the various products.

Testing of Passenger Car Cleaning and Painting Materials

Railroads generally purchase paint and cleaning compounds to a specification where practical. From the purchasing agent's standpoint, this is ideal as it enables him to obtain competitive prices. From the technical standpoint, however, a specification does not permit a manufacturer to utilize the latest developments in his field which in a number of cases would result in a better and, probably, cheaper product. Consequently a progressive railroad will purchase proprietary as well as specification items.

It is the concern of the engineer of tests to see that the products furnished meet the requirements and are suitable for the purpose for which they are intended. When a sample of paint is received in the laboratory, the first step is to evaluate the material by various methods. This gives information whether the requirements have been met, or if the item has not been purchased to certain requirements, if the combinations are consistent with good practice.

Determination of Drying Time

One of the tests made is the determination of drying time. If the paint does not set up and dry within a reasonable time, dust will settle on the surface creating an unsightly appearance and may necessitate the job being re-done. Trouble would also be experienced if masking tape were used over poorly dried films. The finger touch method is generally used to determine drying properties. A paint film is considered set to the touch when it is lightly touched with the finger and none of the coating adheres to the finger. It has dried hard when pressure can be exerted between the thumb and finger without movement of the film. Close adherence to the specified drying times is necessary as they have been established to conform with shop schedules to permit uninterrupted flow of material on the production line.

Some of the complaints the laboratory receives is that the paint is too thin or has livered. Such complaints are justified because the body or viscosity is directly connected with the proper application of the paint to produce a film of satisfactory appearance as well as good protection. Various chemical reactions sometimes occur between the vehicle and the pigment in a paint resulting in a false body or even livering. Such paint is generally useless because if it is excessively thinned, the chemical balance of the constituents are disturbed. The most economical practice would be to return such paint to the manufacturer for replacement. The instruments for checking viscosity are usually of two types: the simplified efflux type which measures the body of the paint by the number of seconds required to flow through a standard orifice and the torsion type which measures the consistency of a paint by the speed of a rotating member immersed in it.

Lack of Covering Capacity

A paint lacking the power to obscure the surface to which it is applied, fails to serve its purpose to protect and preserve. This quality of a paint is known as the relative hiding power. This test is usually performed in accordance with the American Society of Testing Materials Method D 344-39 and consists primarily of checking the relative hiding power of a definite weight of paint over a prepared test surface and compared with the prepared samples of standard paint.

One of the most important things one must consider from the standpoint of public opinion is good appearance of passenger equipment. This involves control of color and gloss. Color matching has always been a difficult matter whether based on wet samples or spray-outs due to changes in shade resulting from various chemical reactions. A method developed by a western printing company is now being used by a number of railroads with considerable success. It is based on the use of color charts prepared by a special process which are said to retain the original shade for periods to twenty years. They can be obtained to match most types of finishes.

A high gloss on the exterior of a passenger car tends to create a favorable impression in much the same manner as on an automobile. The extent of this gloss can be measured by the use of a gloss meter. Such an instrument assigns a definite value to the reflective properties of the paint film ranging from a flat finish to a high gloss. With such control the paint manufacturer can furnish any gloss desired by the consumer with reasonable accuracy.

Effect of High Train Speeds

The high speeds of the streamliners today subject the exterior of the passenger cars to considerable impact damage from flying gravel and sand. The extent of abuse a paint film can withstand is determined by impact tests. One of the simplest methods is the dropping of various shaped tools on the paint film. For example, small pieces of steel rod ⅜ in. by 2½ in. are shaped at one end to either a round, chisel, flat or triangular nose to simulate different kinds of road ballast. These are dropped through 24 in. x ½ in. tube striking the panel placed under the tube. The results are evaluated on the basis of chipping or indentation of the paint film. This test is generally combined with the toughness test as they are more or less related. Toughness is determined by coating tin panels with the enamel or paint, drying over night and then baking for a specified time. When cool, the panels are bent 180 deg. F. over a ⅛ in. rod. Brittleness or lack of toughness is indicated by the development of cracks at the bend.

Abrasion is not only caused by flying sand, but also car washers now being used by the various railroads. Therefore, the abrasion resistant properties as well as the effect of cold and hot water, and chemicals on the finish are factors that must be considered. One type of instrument used to determine how much wear a paint film will withstand, and specified in some specifications including those of the Federal Government, consists in determining the loss in weight of the coating being abraded by standard rubber wheels for a designated number of cycles. Obviously it is only a comparative test and will not indicate wear under actual conditions. It is useful, however, in rating competitive products.

The cold and hot water resistance is determined by immersing coated tin panels in boiling water for 15 min. and cold water for 18 hrs. Only top quality products will stand this test without changes in color, gloss, and other film properties.

Cleaners Can Be Damaging

Since various acid, alkali, and hydrocarbon emulsion mixtures are used in car washers and other washing systems, tests must be made to determine the extent the paint film will be affected by these products. The films are prepared by dipping large test tubes in the paint or enamel being tested and allowing to dry in an inverted position. This process avoids edge effects which would result from the use of flat panels. These coated tubes are then immersed in 10 per cent hydrochloric acid, 10 per cent sulphuric acid, 10 per cent sodium carbonate, 5 per cent sodium hydroxide, saturated oxalic acid, and mineral spirits for varying periods of 2 to 8 hrs. The films are rated on the basis of softening, loosening from the support, discoloration and blistering. These are accelerated tests and some of them are quite severe. Failure to pass any particular one does not necessarily condemn a product. It gives some idea of what can be expected under normal or abnormal conditions and serves as a means of classifying competitive brands.

In the final analysis, the best criterion for judging quality of paint or enamel is the exposure test. Outdoor exposure tests have been conducted for many years by paint manufacturers and others. However, it is time consuming and usually results are desired in a much quicker manner. This is accomplished by the weatherameter which exposes the paint to artificial sunlight in addition to heat and moisture. Various cycles can be established to duplicate different kinds of weathering conditions. Results obtained by this method must be interpreted with caution as it does not include the effect of corrosive gases, extreme cold, acid conditions, high humidity, salt water or the abrasive effect of wind-driven grit and dust. It does afford a good method for comparing products with established standards. It also gives indications of the amount of fading, chalking, loss of luster and the erosion or washing of the film one might expect in actual service. The nature of film failure such as checking, flaking and scaling is important advance information from the point of view of having a suitable surface for repainting without expensive cleaning.

Complex Modern Detergents

We now come to the question of cleaning compounds for passenger equipment. The dirt that must be removed may consist of fatty oils, grease, oily deposits, tarry residues, metallic compounds mostly iron, siliceous matter and alkali dust. The average conception of a cleaning compound is that it consists of soap or washing soda. But the modern detergent is much more complex. It may include soap, sodium carbonate, sodium bicarbonate, sodium hydroxide, sodium sesquicarbonate, monosodium phospate, disodium phosphate, tri-sodium phosphate, sodium hexametaphosphate, sodium pyrophosphate, sodium acid sulphate, borax, oxalic acid, hydrochloric acid, sodium silicate, wetting agents and synthetic soaps. The combinations used depends on whether the cleaner is to be used for light or heavy duty. Hard water solutions require certain types of phosphates to solubilize calcium and magnesium compounds to prevent their precipitation on the surface in the form of a hazy film. Wetting agents increase the penetrating properties. The synthetic soaps can be used in either acid or alkaline solutions. It is the duty of the chemist to determine by chemical analysis if the combinations used are satisfactory for car cleaning. Excess alkalinity would reduce the gloss and soften or even remove the finish coat. Excess acidity would create corrosion problems and affect the color by its bleaching action. Chemical analysis also detects cleaners that have been over-loaded with inert compounds that have no detergent value. Some liquid types have been found to contain as much as 98 per cent water for which a high price was asked. When the laboratory tests have shown that the formulation is a sound one and that it will not damage the paint film, a terminal test is conducted under the supervision of the Test Department for the final rating as to its efficiency in cleaning cars.

In this discussion, I have tried to show how the work of the test department fits in with the painting and cleaning operations of the railroad. Co-operation between the shop forces and technical groups is essential if each is to profit by the others knowledge and experience. The test department is the connecting link between the manufacturer of cleaning and painting materials and the railroad. It not only serves to maintain quality but is also concerned with proper application. Although not a part of paint testing, the preparation of the surface before priming or other painting plays quite a necessary part, because if the surface is not free of grease, rust, water or other defects, the careful examination of the paint in itself is wasted effort.

The report was submitted by a committee of which E. M. Driscoll, foreman painter, C. M. St. P. & P. was chairman.

Discussion of Report on Painting

N. E. Carlson, assistant master car builder, G. N., St. Paul, Minn., said that manufacturers are in many instances being unfairly blamed for poor results with their materials which may be the best available for the price paid. He indicted that paint failures often occur because of improper application or subsequent care. For example, excessive use of putty in building up surfaces may cause trouble, and paints lose luster with careless cleaning. Mr. Carlson said that all cleaners with enough guts are good, but must be used carefully. Illustrative of what should not be done, Mr. Carlson said that after two years service on the Empire Builder two out of 12 cars showed a lack of luster which it developed was due to the cleaner being applied by hand at one terminal late in the forenoon and allowed to stand while the men went to lunch.

W. J. O'Brien, general car foreman, Nickel Plate, Chicago, referred to paint failures which cause rapid deterioration of folded step designs and asked what could be done about it. One suggestion advanced was the more extensive use of stainless steel in this construction.

C. W. Kimball, supervisor of car inspection, Southern, asked if there is any preference as regards the use of acid or alkali-type cleaners on steel passenger equipment. One reply was to use the acid cleaner first and then alkali to neutralize the acid in crevices. The concensus was that whichever type is used, cars must be thoroughly rinsed afterward.

A representative from the D. & R. G. W. said that equipment appearance sells service and the painter foreman must sell himself to his superior officer. He said that on his road passenger cars follow the sun all day formerly faded on one side, but this problem has now been solved by use of proper paint materials and careful cleaning. He raised the question about how painters can avoid being thrown out of diesel locomotives and said they must insist on having enough time to do a good painting job on diesel locomotive interiors. He stated that the excessive use of putty in smoothing or building up diesel front ends under the finish materials is causing trouble.

A paint chemist from the Santa Fe called attention to the difficulty in using two types of cleaners in mechanical washers unless especially designed for this purpose. He said the contemplated use of an alkali cleaner in the car washing machine and acid type the next day would be impractical because irregularity in individual car assignment might result in some cars getting one treatment exclusively.

L. A. Hartz, painter foreman, I. C., said the use of alkali cleaners avoids the necessity of trying to wash acid out of crevices in the car exterior surfaces.

President Deppe said the vinol-resin-type painting material seems to be resistant to both alkali and acid cleaners, but some penalty has to be paid in loss of gloss an added cost.

A. W. Leitner, assistant superintendent car department, S.A.L., Norfolk, Va., suggested an A.A.R. study to recommend materials and methods for satisfactorily cleaning passenger car equipment.

L.M.O.A. Breaks Attendance Records

With a program of four addresses and nine technical reports on diesel and personnel subjects meetings attract large groups

For the first time since the Locomotive Maintenance Officers' Association was formed in 1939 the registration at the September meetings this year passed the 900 mark and the total membership of the association, at the close of the convention had reached a record high—3,515.

F. K. Mitchell, manager, equipment, New York Central System, addressed the association on the vital necessity of making adequate plans for future mechanical servicing and maintenance facilities. His address was abstracted in the October issue, appearing on page 63. In addition remarks were made by W. T. Faricy, president, A. A. R., and J. H. Aydelott, vice-president operations and maintenance department, A. A. R., following the presentation of life memberships in the association and an address was made by E. H. Davidson, director, Bureau of Locomotive Inspection, Interstate Commerce Commission. Nine technical reports were included in the program, as follows: Winterization of Diesel-electric locomotives; report on water and oil leaks, air filters and extension of inspection periods; report on diesel truck maintenance, welding and the servicing of steam power; shop tools; diesel material reconditioning; diesel terminal facilities and a report on the cleaning and testing of traction motors and other electrical equipment.

P. H. Verd,
President
(Superintendent motive power and equipment, E. J. & E.)

Safety and Locomotive Operation

Mr. Davidson discussed safety in relatio to diesel-electric locomotive operation and said, in part:

"During the past ten years there has been an accelerated trend toward the use of diesel-electric locomotives until today over one third of all locomotives for which reports are filed with the Bureau of Locomotive Inspection are propelled by power other than steam.

"The ratio of accidents to the number of defective steam locomotives found by our inspectors has shown a considerable increase in the years following World War II as compared with the corresponding years before outbreak of hostilities. This situation may be due in part to increased age of the steam locomotives combined with the beating they took during strenuous days of war transportation but I suspect there may be other considerations involved. In our interest in the glamour girl of the rails, the diesel, let's not forget the steam locomotives of our rail system and see that they are properly maintained.

"When steam locomotive repairs are called for on engineer's or inspector's reports these repairs should, in the interest of safety and economy, be made in a thorough and substantial manner. If this procedure is followed there will be fewer defective locomotives found by our inspectors and there should be correspondingly fewer accidents caused by defective parts or appurtenances of locomotives. I suggest that a procedure whereby work reports could be reviewed in order to determine whether identical items are reported time after time would be helpful. If the same item on a locomotive is continually reported by several engineers it would appear that repairs may have been inadequate or some condition exists that requires mechanical or technical consideration.

H. H. Magill,
First Vice-Pres.
(Superintendent locomotive and car shops, C. & N. W.)

C. M. Lipscomb,
Sec.-Treas.
(Assistant to schedule supervisor, M. P.)

"The safety movement on railroads is perhaps the grandfather of all industry wide safety movements. The railroads have supported this movement enthusiastically both financially and by delegation of personnel to study the problem, determine causes of and remedies for accidents and to carry the gospel of safety to all employees. The cost of accidents in terms of financial loss and human suffering is now a matter of national consideration. We cannot waste our human, industrial or transportation re-

sources any more than we can permit waste in our agriculture, forests or mineral reserves.

"Industry is today doing something in a big way about industrial accidents. Can we in the mechanical branch of railroad transportation do less? I think not. Railroads have had safety organizations for decades. They have safety committees, supervisors and members of the various crafts who have had the benefits of educational programs. We have the know how; all that is required is perseverance.

"Failures that have occurred in wheels under diesel locomotives are cause for concern. Two serious derailments have been caused by wheel failures and in addition we have record of a number of wheels in which extensive and dangerous cracks have developed under service conditions but fortunately did not result in casualties. Perhaps the most spectacular failure was one where a circumferential crack developed in the plate at base of rim fillet, extended completely around the wheel and resulted in complete separation of the rim from the plate. The subject of wheel failures is being intensively studied but procedure to eliminate cracks has not as yet been finally determined. The gravity of the situation requires that wheels be given frequent and meticulous inspections while in service in order that defective wheels may be discovered and removed before failure occurs. Because of exterior inaccessibility the units should be placed over a pit and moved as necessary to permit examination of all parts of both sides of each wheel. Cracks are usually fine and difficult to find unless suraces are cleared of scale, dirt and compound deposits which cover or obscure surface cracks associated with progressive or fatigue failures. One railroad which had an unfortunate experience with a failed wheel is going to the extent of whitening wheels at time of pit inspection. The careful inspection of diesel wheels at intermediate points when locomotives are used in long runs is strongly recommended.

"Other safety measures on diesel locomotives which merit attention are application of safety hangers to unsupported brake rigging which will prevent the rigging from falling to the rail in event of a hanger pin failure, application of long fuel tank gages and means to prevent loss of oil in event of a broken oil gage or fitting on fuel oil tanks; removal of accumulations of oil soaked litter and debris from tops of oil tanks and other locations where a spark could cause a stubborn fire; elimination of leaks which deposit oil on passageway floors and other walking surfaces and which have been the cause of a considerable number of injuries from falls.

"A number of defects have been reported in connection with jumpers and connectors between units. Use of jumpers of improper length which hang low enough in passageways to strike the face of a man hurrying from one unit to another create an unnecessary personal hazard. The deterioration of protective rubber coverings and fraying of insulation increases the danger of fire and short circuits. Use of jumpers having protective covering made from rubber synthetics which are more oil and abrasive resistant than natural rubber might merit consideration.

"These matters which individually do not appear large are best described by the term poor housekeeping. If units are adequately policed and inspected the danger of accident will be correspondingly reduced and economy should be effected by reduction of heavy repair expense caused by neglected repairs."

Training Diesel Personnel

Interest in any subject is a prime factor, for without it we cannot expect the information being taught to be effecive.

The personnel to be trained must be interested. The means employed to accomplish this then is of first importance. There cannot be any acquisition of knowledge without proper interest in the subject. A stimulus to arouse interest must be used where individuals do not manifest interest.

All previous committees labored with the problem of interest. I cannot think of any greater need whether directly, or indirectly, connected with diesel locomotives, than an attitude conclusive to a desire to acquire all the knowledge relating to any particular phase of diesel operation. All mechanics whose basic trade relates to this type of power will find themselves easily adjusted to the transition if they will but manifest a responsive attitude, or interest in the essential training.

The interest in this subject is incumbent on both management and labor, since each, when analyzed, will be found dependent on certain factors relating chiefly to the subject of interest. Management and Labor, since each, when analyzed, will be found dependent on certain factors relating chiefly to the subject of interest. Management must realize the need of trained personnel. The value of the equipment is so great that the loss of available working hours is much more critical than is the case for equipment which is not so expensive. Management realizes that an investment, to bring proper returns, must have the highest availability. To have high availability, they must have trained personnel.

Labor must recognize its responsibility and cooperate with management in the development of trained personnel. This type of power should challenge the initiative of Labor since its scope has promise of security. There must be a mutual understanding between Management and Labor through which the progression of methods of training can best be advanced. Labor should likewise see the importance of their contribution to the welfare of the industry, and in so doing, their welfare and livlihood.

Each should see their common interests are at stake—management through proper returns on investment and in better care and maintenance of equipment. Labor should be able to see the perpetuation of their skill through training, affording opportunity for youth, and security for the aged. From the workman's point of view, his very soul should pulsate with a burning desire to know. If the committee can set forth in this report the proper perspective of the possibilities that can be realized in the field of education through interest in personnel training, then the other phases of the actual methods of training will be easy.

First, we must arouse an interest in the young man who wants to learn, the mechanic who already has a basic knowledge of the fundamentals relating to the trades employed in diesel repairs, and the helper who did not have an opportunity to serve an apprenticeship. To the mechanic who will apply himself, there is opportunity ahead. All members of this Association should study ways and means to cause a desire in all their employees who might be needed in diesel work to interest themselves in making the most of the opportunity that can be offered by their respective railroad. Likewise, labor, as a whole, should work with management to the end that skill of workmen will be commensurate with the growing need brought about by the expansion of diesel power.

When considering the classification of personnel that should be trained, everyone employed in Diesel work, whether servicing, maintaining, or supervising should be trained in accordance with their responsibilities.

The classification usually found on Class I railroads might be summed up as follows:

1. Apprentices—through standard 4 year apprentice courses; 2. Upgraded employees; 3. Mechanics—already qualified on other types of power, such as steam locomotive men; 4. Supervisors. This generally represents the class, or type of personnel coming under the scope of this paper.

The necessity to create interest in the apprentice should be briefly explained that his apprenticeship has within it the potential possibility of training him to be skilled in diesel work and the rewards are directly dependent upon his attitude and ability to follow the courses outlined by his company under the four year apprentice system.

Upgraded employees, somewhat like the apprentices, should be sold upon the merits of being trained, and their interest directed to the possibilities afforded through training.

The mechanics that have been previously trained in other types of power should be encouraged to apply themselves in this new type of work, and their interest should be cultivated in such a manner as to impress upon them the importance that to be skilled in the maintenance of steam power, or other power, required a skill that they had to acquire, but it is not enough to rest upon the laurels of the trade previously learned unless they are checked for their relation to this new type of work, therefore, interest can be created by the proper approach, comparing methods previously employed by the methods that will be required, and if by skillful comparison an illustration is made, the need of interest then is apparent.

The training of supervisors for supervisory work has been treated upon previously before this association, but the need for, and necessity of interest on the part of supervisors possibly is the greatest factor in the element of interest, because it is through the supervisors that the need for both management and labor can be made known to the working personnel. A supervisor is the go-between, the mouth piece of management to set forth the need for interest on the part of all that he supervises, and he himself must be conscious of this need before he can disseminate correct information, and correct instructions. No man is skilled as an instructor unless first sold on the subject he is teaching. Interest then is propigated by discussion of interest elements or factors relating to the demand. Labor under the various types of classification then should recognize their responsibility in aligning themselves with the problems of interest in order that this subject can be effectively pursued.

How to Create Interests

Here we find a close relationship to the need, or necessity of interest, since it can be readily understood that to create interest there must first be a need. The factors of mental thought in which interest has been aroused must be centered on the subject into what might be termed the ability to concentrate in such a manner that knowledge will be acquired through training procedures. It follows then that there must be produced the proper stimulus, or interest elements, to produce or create interest. Then the results of efforts put forth through methods employed will produce the desired results. The approach to this problem, "How to create interest," will be in direct ratio to management's ability, through instructors using elements of interest, to produce a trained employee, since if an employee undergoing training fails or lacks in interest, there will be no infusion of knowledge of the subject taught, as information relating to the diesel locomotives must fall into proper sequence, beginning with basic fundamentals and gradually enlarging until all subject matter has been taught to cover details necessary to a well-rounded knowledge of the diesel locomotive.

Instructors, whether they be supervisors in shops, or in class rooms, must recognize the effectiveness of information they are treating upon. The intended purpose is to implant in the minds of those being taught, and being trained, the ability to retain such information, which must be forcibly and effectively paneled. The effectiveness of teaching or training is tantamount to he ability of the instructor to inspire the one being trained, *since without interest there can be no expected results.* Then it follows that there *first must be a need* (which has already been set forth): *second, a desire; third, desire will, when* inspired, find a way to its realization. From these fundamental principles we have the success or failure of the effectiveness of training.

The ability to create must also have within it inspiration. In this we have then, the fundamental elements of how interest is created. We find these principles employed in salesmanship, and without these elements we fail to sell. Therefore, instructions given by instructors must be characterized with elements of interest, setting forth the need for such training.

The question of how to create interest can best be understood when we approach the subject from the proper perspective. The subject, or person to be trained, first of all, must have within his own mind a well fixed motive, motivated by his own desire that will incite him into action, and as a result we will have an infusion of knowledge into the personnel being taught.

We must understand that to create interest, the subject being taught is not necessarily new to the instructor, but he is endeavoring to teach the subject under consideration in such a manner that it will fasten itself upon the person being taught. The acquisition of knowledge as we review the success of any endeavor, is by a gradual process, or a desire in action. To illustrate; interested personnel is like unto an undeveloped resource, all of the potential possibilities are there. The exploitation is a challenge to management to fully utilize training methods in their possession, or upon their railroad to the fullest advantage. It is through these means that interest can be created because there is within the possession of every railroad sufficient personnel and materials to adequately instruct their personnel, if personnel manifests a responsive attitude, then trained personnel will be the result.

The greatest success in how to create interest is to never approach the subject of training from the standpoint of it being too difficult, but that by proper attention and attitude of the person being trained, when assured by those teaching, that this subject has clarity, and can be easily understood when given the necessary attention.

Briefly, training methods might be summarized as: 1. Handling every subject individually; 2. Don't give a man more than he can understand in any one session; 3. Break the subject down into small steps.

With these assurances, training procedures can be gone into with the personnel to be trained with a premise well fixed, and that is, that they will not stagger under the magnitude of the scope of the diesel locomotive.

Every person must be convinced that the diesel locomotive is not something which is impossible to understand, but that the application of good common sense with a little additional knowledge will enable anyone to do the required work. Every phase taught should be characterized in such manner as to create confidence in the personnel being taught. Allow personnel the right of individual initiative wherever possible to stimulate his reasoning. By so doing, his training will then have the quality so necessary after it has been considered finished, which has had in it the element of self initiative, and by this initiative will be able to apply himself properly.

The creation of interest will depend largely upon the conditions found in the various company shops and enginehouses, and training can be suited to such conditions. A review of what the training consists will be of great importance, since the one being instructed should have a perspective, or a goal to reach. This means self evaluation, or knowledge of subjects, or break down of work would be the natural thing to expect of the person being taught in which he would ask himself how much he knows about this or that, etc.

The diesel locomotive must be pictured to the maintenance forces as power that requires the proper respect, and we place first in the category of training of the untrained man that this type of power demands cleanliness. We cannot place too great an emphasis on the subject of cleanliness, for in this we must first impress the trainee that we are dealing with an art that demands respect for cleanliness. The intracacies of this machine, whether related to the internal combustion engine or to the electrical control or power circuits will be best maintained when personnel being trained have instilled into their basic training that cleanliness is a demand in which the art of the how to perform diesel work demands the utmost respect and the instructor should ever keep before the trainee, and teach him to watch out for the extrinsic and intrinsic forces that are brought to bear in this work that are shrouded in the elements of uncleanliness. Continued, or sustained, interest into all the ramifications of this subject should carry with it color and emphasis that the art, or skill be characterized with pride, and that pride can only be exemplified when presented

clean. *Let this ring throughout the classroom, the instruction car, in the shops, in the enginehouses, and on the diesel tracks until it will become a by-word to the personnel.*

While this paper is addressed primarily to mechanical and operating personnel which might be expected to perform maintenance work, management through its supervisory personnel should teach all personnel that cleanliness is a demand on every person who comes in contact with the diesel locomotive; to the operating personnel, pride in the handling of materials, and the use of this locomotive should be characterized with cleanliness, and solicit that they give this the consideration due. Likewise the forces engaged in the cleaning of the locomotive, whether they be laborers, or helpers, should be taught how to respect and how to perform a good job of cleaning. There has been damage done to diesel locomotives simply because the working personnel has not been trained in the art of cleanliness, and this should be emphasized. This section of the paper is devoted to other than the maintenance forces which will include, as stated above, the laborer, helper, and the operating man, not necesarily engaged in repairs, but simply that the lessons of how to keep clean themselves and how to keep the locomotive clean a consideration of first importance.

No attempt will be made to advise railroads in their methods of grading, since it will be noted that the purpose of this paper is to create interest and how to train diesel personnel. Every road, when setting up its methods of training should be able to evaluate its personnel by grades, or classification, peculiar to its operation. Most Class I railroads issue apprentice certificates at the completion of their apprenticeships. Upgraded employees can be certified by the proper mechanical officer who can verify with respect to their knowledge of the work in which they are engaged. Mechanics already trained can be certified when they have acquired the technical knowledge necessary to diesel work. Supervisors who are promoted, after they have been trained in diesel work might be graded strictly on their supervisory ability, by the proper mechanical officer. It would be normally expected that they would have a basic knowledge before being placed in charge of diesel maintenance or repairs.

This report was a presentation of a committee of which E. V. Myers, superintendent motive power, St. Louis-Southwestern was chairman.

Centralized Reconditioning Facilities

With the rapid dieselization of the railroads, modern diesel back shops have become a prime necessity. Many diesel locomotives are no longer new, and the accumulation of mileage and age has created an increasing demand for modern heavy repair shops.

The economies realized from the modern centralized reconditioning facilities are (1) Higher locomotive availability; (2) Lower "between-shop" maintenance costs; (3) More efficient locomotive operation.

Of the three, the higher locomotive availability is by far the most important. Availability was the main selling point for the diesel locomotive and unless modern back shop practices are followed, the primary purpose for which the locomotive was purchased will be defeated. It has been stated that if a 10 per cent improvement in the efficiency of the locomotive were to result in a 10 per cent reduction in fuel cost, the percentage reduction in total cost of operating one train-mile would be only 2 per cent. When availability in a fleet of locomotives is considered, substantial savings may be obtained by a small percentage increase in the number of locomotives available for service.

In the selection of a site for the shop, future, as well as present day, power assignments must be given consideration. As additional locomotives are placed in service, a central location today may prove otherwise in the future. The source of repair parts and raw materials should be studied, and the shop should be located so as not to impose excessive freight charges on these supplies.

The money available for the construction of shops is a governing factor when determining if an entirely new shop shall be built, or if some existing shop is to be converted. On some railroads it has been necessary to retain part of the shop for steam locomotive repairs. Many shops lend themselves readily to this plan.

When converting a steam shop for diesel repair work, several problems must be considered, among them being the delays allowed in the existing steam locomotive repair schedule, and the ability of other shops on the system to absorb the classified repairs that are necessary to keep the remaining steam locomotives in proper condition. A considerable amount of foresight and planning must be used if serious delays in steam locomotive schedules are to be avoided.

The basic equipment and machinery required in a diesel heavy repair shop will depend entirely upon the number of locomotives to be maintained and the extent of the overhaul that the railroad wishes to make. In some cases the manufacturer's "repair and return" and "unit exchange" may prove economical and a complete cost study should be made on the repair operations before the basic machinery is purchased.

An example of actual back shop layout is the Baltimore and Ohio's new diesel shop at Glenwood, Pa. This was a steam back shop converted entirely to diesel work. The shop is 638 ft. long and 232 ft. wide, and contains three bays. The side bays are serviced by a 30 and 15 ton overhead crane. In the center bay are two 100-ton overhead cranes with 15-ton auxiliaries. The center bay contains 3 tracks with depressed floors, and 100 ft. platforms on the inbound and outbound tracks. The third track is equipped with a 60 and 90-ton drop table for damage and heavy running repair work that is too extensive for the ordinary enginehouse. One of the side bays contains facilities for engine cleaning, painting and overhaul, injector, fuel pump and power assembly work. In the other side bay is located the electrical shop, machine shop, pipe and tin shop and storehouse. On the overhead balcony the air pump repair work and air brake test racks are located as well as a class room for diesel locomotive instructions.

To illustrate the functioning of this shop, we will follow a unit through its course of heavy repairs.

First the unit is drained of fuel, lube oil and water, just outside the door on the incoming track. As the unit enters the shop adjacent to the platforms, the hatches are removed and the engine is lifted from the car body and placed on a dolly. The engine is moved to a totally enclosed wash rack, where it is cleaned externally. Moving along the dolly track, the engine is taken to the disassembly spot, where it is completly stripped. The engine parts are cleaned thoroughly in several modern cleaning machines, while the crankcase is immersed in a special 8-ft. by 16-ft. cleaning vat.

The engine parts, accessories, and crankcase are moved on an assembly line basis down the side bay to the non-destructive testing, inspection and engine parts repairing section. Located at this point are the various jigs, benches, honing machines, valve grinders, etc., that are used for repairing and reconditioning the engine parts. After leaving the repair section the crankcase is painted in a spray booth and placed upon a dolly, ready for reassembly. The work is all done on an assembly line basis as much as possible, using roller type conveyors for the handling of engine parts. Unnecessary movements are kept to a minimum, in fact the cleaning machines, paint spray booth, work benches, tool room, etc., are all located within 20 ft. of the center line of the engine dolly track.

In the meantime, the car body has been lifted from its trucks with the 100-ton overhead cranes, and placed on trestles for body and cab work, and rewiring where necessary. The trucks are moved to the truck repair section which is located at the far end of the center bay. Here the trucks are inverted and dismantled, and handled on an assembly line basis. The wheels and axles go to the machine shop for turning and burnishing, while the traction motors are taken to the electrical shop located in the adjacent bay.

At the present time basic motor and generator overhaul only is being done in the electrical shop; this includes bearing renewal, commutator reconditioning, motor cleaning and baking, traction motor frame repairing, battery, contactor and miscellaneous electrical parts cleaning and repairing. No traction motor or generator rewinding work is being done at the present, but future demands may warrant facilities for these heavier repairs, and space has been allocated for this work.

The reassembly of the locomotive begins with the placing of the car body on the reconditioned trucks. The engine, generator and accessories are reapplied after the locomotive has been moved to the platform section on the outgoing track. From here the locomotive goes to the roundhouse, where several stalls have been converted to a paint shop. The external painting is done in this shop.

The locomotive is now ready for load testing. The performance of the engine can be closely observed under load test, and particular attention should be paid to the water, oil and bearing temperatures. Any defective material or improper tolerances should be discovered at this time. The money spent as a result of a crankshaft failure may well pay for the installation of a complete engine load tester.

For any efficient shop operation, the scheduling of locomotives and flow of materials are vital points. As an example of good scheduling, one railroad is able to give a unit a complete 30-month (350,000 miles) overhaul in four 8-hour working days—completely load tested and back in service. They are able to do this by having two spare trucks, one complete engine, four spare cooling fan motors, four blower fan motors, and spare fuel pump and cab heater motors. They use advanced scheduling so that all material is reconditioned and ready when the locomotive arrives in the shop.

Diesel Truck Repairs

Two systems are generally employed for maintaining and repairing trucks of diesel units. With one system a railroad will remove trucks as a unit after a predetermined span of time depending upon mileage or months of service, replacing such trucks with new ones or trucks that have been overhauled. With this system if a defective motor has to be changed out, or wheels need replacing for any reason, the entire truck or trucks of a unit are changed out, regardless of mileage or months of service. This process will be repeated as occasion demands until the trucks proper required complete overhauling due to expiration of time or mileage. In the other system—known generally as the progressive system, wheels and motors are changed out on drop pit at times prior to the time for overhauling trucks under this class of power. The progressive system is more generally used by railroads.

It seems to be standard practice on railroads where the progressive system is used to remove multi-wear wheels after about 100,000 miles of service for necessary turning; to remove motors after 200,000 to 300,000 miles of service for inspection and necessary repairs; and to remove the entire truck after an average of 600,000 to 1,000,000 miles for repairs or replacement of bushings, pins, wear plates and similar parts.

The ideal system to be adopted on any railroad is the one where diesel units will be available the largest precentage of time. Generally there is a layover period of from 4 to 6 hours between runs at repair terminals for necessary running repairs, inspection, etc., so that with either system the item of availability will be fairly comparable.

Under the progressive system it is important that change-out terminals have sufficient wheels on hand to mate up with other wheels in the unit, especially wheels that are equipped with motors. If this is not carefully watched, wheel slippage will result making it practically impossible for controls to function, particularly when the speed of one driving wheel is not within reasonable tolerances with its mate. An unbalancing condition must inevitably result with miss-mated power wheels. Builders of diesel power generally recommend the difference in diameter of driving wheels shall not exceed 1 in. Filler blocks between equalizers and journal boxes should be applied where wheels of different diameters but within 1 in. are used so that the truck may be kept level. If this is not done, instead of bearing uniformly on center castings, there will be point contact only causing damage through the center casting which is part of the bolster. On EMD type F-3 frame units, the body bolster being the weakest construction, plates will work above center castings and cracks will develop. This is due to the close tolerances at wear plates between bolster and truck frame. These approximate 1/16 in. to the foot before binding sets up and unless filler blocks are installed damage inevitably results. In a previous section of this report it is stated multi-wear wheels require turning after about 100,000 miles. This figure can vary—based on reports at hand—from 90,000 to 200,000 miles it being generally admitted wheel wear will be much less on straight level road bed than it will be under operating conditions involving many curves and grades.

The question of investment in spare equipment and facilities in many cases is the determining factor in adopting one or the other of these two systems. It is admitted that if a truck can operate approximately 600,000 to 1,000,000 miles in passenger service and from about 300,000 to 400,000 miles in freight service without renewal of pins and bushings, pedestals, wear liners, frame, equalizer and swing hanger work, etc., or without making it necessary to strip the truck completely account of renewal or replacement of wear plates, etc., then under the progressive system of truck repairs the wheel and truck work having been handled at stated intervals, the work of repairing or rebuilding the truck is considerably simplified. However, under these conditions spare wheels for continuity of service must be spread over many points, advisedly terminal points on a particular railroad, with the same logic applying to motors, therefore more wheels will be required as compared with the system where entire trucks are changed out.

On roads where the entire truck assembly is removed whenever a failure of any type occurs, or when wheels are to be turned, etc., proper somewhat special equipment must be made available at change-over points and in addition considerable number of spare trucks, complete in all respects will be required involving a very large investment in this type of equipment, which condition is considerably aggravated by the different types, makes and services being performed by diesels on a given railroad. Conversely, the investment in spare equipment under similar conditions will be much less if the progressive system of repairing trucks is in operation.

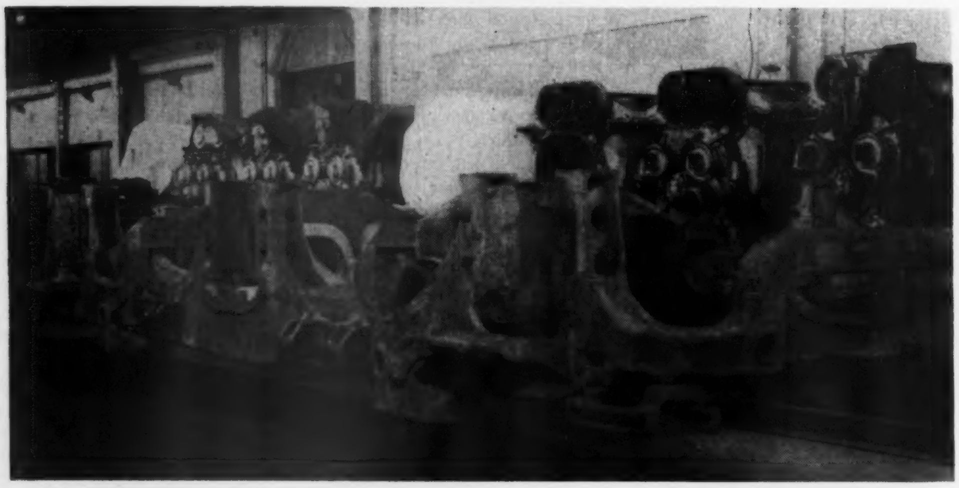
Generally swing hangers and equalizers receive attention during the major overhaul of trucks. Some railroads are reworking equalizers by electric welding to bring wear surfaces back to specifications or blueprint; others are reworking these parts in their blacksmith shop where they are heated and formed or forge welded so that after this work is completed they may be normalized, Magnafluxed and if found to be free from cracks, machined to standard dimensions at wear places. The latter practice is more generally followed inasmuch as it seems there have been instances where the electric welding process was used, cracks have developed in the equalizers. Swing hangers and safety guards are of course removed, normalized and Magnafluxed.

A permanent record of this type of work is stenciled on the repaired or reworked parts, particularly on roads using the progressive system, inasmuch as it may be necessary to change equalizers or swing hangers due to having been in service the required period of time. Extreme care must be exercised in placing the stenciling inasmuch as there have been instances where cracks developing after installation have been traced to the stenciling.

The remainder of this section of the report was made up of a number of illustrations showing facilities and practices involved in truck repairs. These accompanying this abstract have been selected as typical.

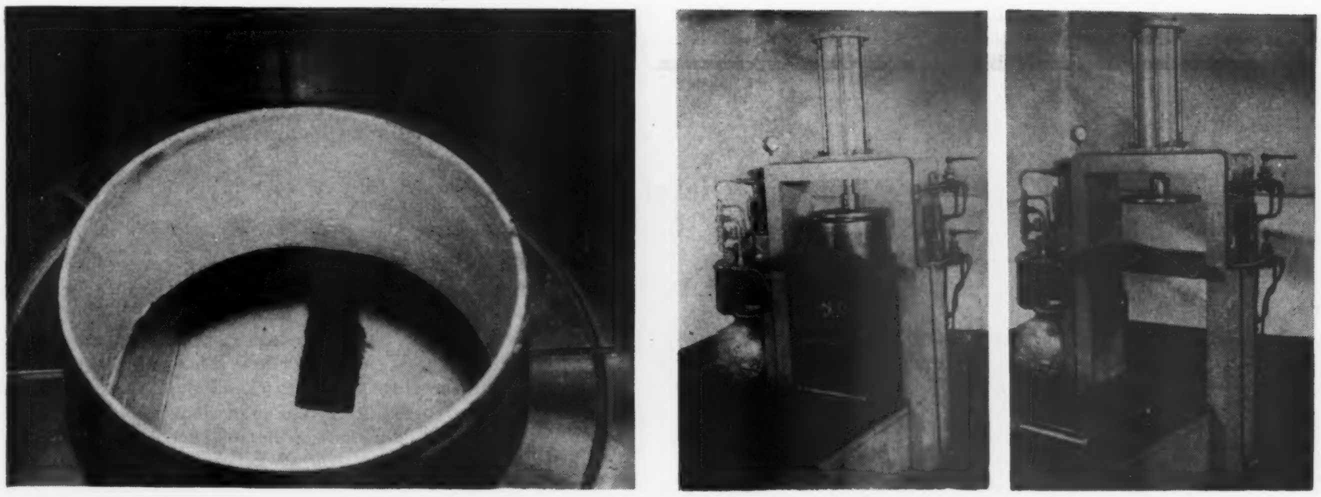
Rigging for compressing springs when dismantling or assembling four-wheel truck-spring hangers

Many roads find it easier to apply coil springs and equalizers by turning the truck frames upside down which eliminates lifting the frames several times



At the left a 50-ton hydraulic is being used to compress the truck springs while the pins are being removed or applied. By the use of this arrangement for lifting the weight of swing hangers and related parts when stripping or assembling trucks the job of handling the pins is simplified. This arrangement is considerably lighter than the one shown at the top of this page which needs a crane

A 50-ton hydraulic jack is used for compressing springs while pins are being removed or applied



(Left) Because of cracks in bolster, reinforcing in the air duct was necessary. A 1-in. by 5-in. by 9-in. piece of steel was used as shown. (Center) Journal-box press used for removing and applying the outer races of bearings. (Right) Pressing the outer bearing race into a journal box

One type of truck repair stand is this elevated track which is about 3 ft. above the floor.

Here is a type of stand, similar to that shown in the above illustration, which is designed to handle a six-wheel truck

[This section, on truck repairs, was part of a report on shop practices submitted by a committee of which C. H. Spence, superintendent of shops, Baltimore & Ohio, is chairman. The remainder of the report dealt with the welding of diesel engine parts and consisted of 17 illustrations with appropriate descriptive material. These will appear in a subsequent issue.—EDITOR.]

Cleaning Diesel Locomotives

The exterior cleaning of diesel locomotives seems to present no serious problems. The trucks, underframes and fuel tanks can be easily cleaned by hot water under pressure or steam. This equipment is available in most cases as it was universally used on steam locomotives. If the build-up of grease on the trucks and underframe is heavy it would be advisable to spray with a solution designed to loosen this film. A good cleaning program will prevent this heavy build-up. One-half man hour per unit is ample in most cases for this cleaning. The engine should be operated in about the third throttle position so that traction motor blower air will help prevent moisture entering these motors. Care should also be used to keep the water or steam away from the traction motor openings. This cleaning should be done as often as possible and never less than once a month. The oftener cleaned the less time involved.

The exterior cleaning of the car body can successfully be accomplished in a number of ways with a minimum number of man hours or equipment. The number and kind of units will be the deciding factor. The washing machine will perform this work in a satisfactory manner on certain types of diesels, depending on the contour of the car body. A small amount of hand cleaning may be desirable at times for a real good job. The time element is small, but the cost of the equipment is large.

A home made process can cheaply be set up which consists of two vertical pipes with spray nozzles located about 8 inches apart, starting about 24 in. above the ground and which curve slightly over the top of the car body. The locomotives are passed through a wet-down line, then sprayed with a cleaning solution after which they are washed off with cold water. This is a satisfactory makeshift set up and requires only about 15 minutes per unit when the film is not too heavy. A small amount of hand cleaning is desirable for a good job.

Hand brushing and rinsing is necessary on some types of locomotives. This method does the most thorough job, but requires the most man hours. However, it can be performed inside the diesel facility while maintenance work is being performed. The type of cleaner used will depend upon the film present. Rinse with water, brush on the cleaning solution and rinse with water. The cleaning solution may be sprayed on if desired and then brushed. Two to three man hours will be required per unit.

Interior cleaning should be concentrated on as it presents the most serious problems. Too many man hours are used to accomplish an undesirable cleaning job in the engine room. The finished job may leave an oily film over all parts so dirt can be collected, and the inaccessible places usually neglected. Fire hazards and unsafe walking areas must be eliminated. We can expect the I. C. C. Inspectors to give these conditions closer attention in the future. The design characteristics of nearly all diesel locomotives leaves much to be desired for good interior cleaning. This should be given much future study. A further obstacle in the path of interior cleaning is the fact that work is usually being performed inside the diesel from the time it arrives until it departs.

Hand cleaning takes considerable locomotive time and man-hours to accomplish a good job. Twenty-four man-hours seems to be about the average time to do a good job on a Class F 3, E.M.D. diesel locomotive once a month. The tendency is to clean the easily reached places and make little or no attempt to clean the inaccessible locations. A good vacuum cleaner should be used first and all loose dirt and dust picked up. Then the ceilings, walls, engine and accessory parts should be cleaned with a good cleaning solution that does not leave an oily film. Last the floors should be cleaned. Brushes should be used and must be of proper design to reach inaccessible places. Rags and towels can be used to wipe clean and dry. Too much reliance is placed on the laborer being conscientious enough to do a good job. Supervision must give this phase closer attention.

This hand spraying method consists of spraying a cleaning compound, under light pressure, so as to wet all parts to be cleaned. It is then rinsed down with an air rinse gun. Little water is used, but the air velocity breaks the water into a fine mist. The idea is to penetrate into the cleaner and knock off the dirt and cleaner. While this method uses little water and does reduce electrical difficulties, it has the disadvantage of moving the foreign matter from one place to another instead of knocking it off on floor.

Another cleaning method is to use a hand spray with city water rinse. The cleaner is sprayed, at low pressure, over all parts to be cleaned. A garden hose is then used with city water pressure to rinse down the dirt and cleaner. With occasional hand brushing the unit can be thoroughly cleaned. The water can either be mopped up or taken up by vacuum. The electrical equipment should be protected with canvas shields. Two to three man-hours will be required per unit.

There is also the hand spray method with controlled knock-off rinse wherein the cleaner is sprayed on, under light pressure, to all parts to be cleaned. A rinse gun connected to both air and water is used to knock off the dirt and the cleaner. The amount of water is controlled to a required minimum to preform this work in a satisfactory manner. The electrical equipment need not be covered when this method is used, provided the work is being performed by a competent employee. The amount of water to be mopped up or vacuumed is small. A little hand cleaning and wiping will be required. Two to three man-hours per unit will be required.

When pressure spraying is used with a pressure rinse, the cleaner is sprayed on with about 90 lb. pressure over all parts to be cleaned and rinsed with water under the same pressure. The electrical equipment should be protected with canvas shields. The water can be taken up with a mop or vacuum cleaner. This method of cleaning tends to loosen the heavy coating when the cleaner is being sprayed on. With the coating looser it can be more readily rinsed off. A small amount of hand cleaning and wiping will be required for a good job. Two to three man-hours should give a satisfactory job.

To do a good job of cleaning, regardless of method, the following must be kept in mind.

1. The cleaning compound or solution must be "tailored to fit" the job. Every railroad has some peculiar operating condition. which may deposit a definite kind of dirt. The safety of the employee using the cleaning solution must be considered. The various companies making and selling cleaning compounds will be more than glad to demonstrate their products in a practical manner and help set up a definite cleaning program.

2. Supervision is a must. The average labor gang today is careless and indifferent. Proper supervision will offset this so a better job will be accomplished.

3. Cleaning must be a scheduled maintenance item and independent from all other work to be done.

4. The education of every man on the job should be and can be arranged with no loss of time. The men should know their job thoroughly. The lack of knowledge or carelessness can be costly.

5. Serious study should be made of the various cleaning jobs to fit the railroad's need. When a method is decided upon, the proper tools should be provided.

6. Where possible, natural layovers at points where little or no maintenance work is performed, should be used to the greatest extent possible for the interior cleaning program. Where there are several of these points definite parts of this program can be assigned.

7. Proper maintenance is of greatest importance for, no matter how good the cleaning program is, the benefits of it will be lost unless oil leaks are stopped, smoking steam generators corrected and all other sources of dirt eliminated.

The I.C.C. inspectors are aware of these conditions and make many inspections in bound.

8. Do not expect perfect results the first time a diesel is cleaned in 12 months. Once a diesel interior is properly cleaned, monthly cleaning with good maintenance should keep it clean.

9. The cleaning solution must leave a job, when finished, that is dry and film free.

10. Allow the engine to cool before applying the solution.

11. In all cases where spraying methods are used it is advisable to megger the electrical circuits before and after cleaning. The time required to do this is small and the protection great. Running the engine for an hour after cleaning will usually eliminate minor moisture grounds caused by the cleaning. In many cases the electrical circuits will show a benefit from the cleaning.

12. Make a study of the various types of locomotives to see if a few minor changes could be made that would be beneficial the cleaning program.

This is one part of a report presented by a committee of which L. L. Luthey, general supervisor of diesel engines, A. T. & S. F., was chairman.

Water and Oil Leaks

Water and oil leaks have been a source of trouble and expense from the first appearance of the diesel-electric locomotive resulting in severe criticism being directed toward the railroads while constantly battling the oil and water leaks. These leaks in some cases have been aggravated by poor maintenance originating from defective and improper materials as well as insufficient engineering design. The manufacturers and the railroads working together have made many improvements, however, there is still considerable work and engineering involved before such defects can be eliminated. Another burden presenting itself is that as the engine becomes older it is more apt to develop oil and water leaks.

Water and oil leaks became a major problem when the developments and improvements were made in certain moving parts of the diesel engines which allowed the diesel locomotive to be placed in an operative manner for a longer period between inspections or extended maintenance schedules. The seals and gaskets would deteriorate before the extended mileage had been reached, when heretofore the seals and gaskets were renewed before maximum service life had been reached due to replacement of various mechanical parts.

Water Leaks

The most common water leaks have been on the cylinder assemblies of the Type 567 engine. Water leaks have been experienced at the liner seals, head seals and cylinder head to liner gaskets. The lower liner seals have been changed to a white silicone type of seal costing approximately four times as much as the former synthetic rubber seals. Although this seal has eliminated most of the difficulty experienced with the lower liner seals, it's full savings cannot be realized due to the short life of the synthetic rubber upper liner seal necessitating removal of the liner and assembly before reaching expected life of the lower liner seal.

The cylinder head seals have been changed from time to time, both in material and size, the latest cylinder head seals being made of synthetic rubber. Changes have also been instituted in the cylinder head seal ring. At the present time very little trouble is being experienced with water leaks at this point, providing the cylinder assemblies are removed before reaching the maximum service life of the synthetic rubber head seals.

The cylinder head to liner gaskets have also been changed in design and materials. The latest gasket being a copper asbestos gasket with a zinc coated steel bottom surface with an annealed welded steel wire insert. Recent design cylinder head to liner sealing arrangement now being used consists of a ferrule and grommet water seal, the brass ferrules being contained in the liner water outlet passages by a light press fit and extending loosely into the cylinder head water inlet passages. Each tube is surrounded by a small doughnut seal of silicone material. With the use of this water seal arrangement, a solid copper gasket is used as a fire seal at the head to liner split for protection against combustion gas heat. This arrangement although not entirely new to the railroad diesel engine field, holds high expectations by the manufacturers for performance and possible increased assembly removable periods.

The above mentioned improvements in the sealing of assemblies is viewed with optimism by the railroads due to corresponding liner and head seals of synthetic rubber material having a maximum service life of approximately two years. The different resiliency characteristics of the silicone and synthetic rubber may also present it's problems before present maximum service life can be obtained.

Water leaks have been encountered due to the leaking exhaust manifold studs which protrude into the water jacket and on many of the earlier Type 567A engines cracks developed in the dead air space on the gear train end of the engine. This space being surrounded by water resulted in water leaking into the gear train thence into the crankcase. On many older engines cracking of the top decks allows water to enter the lubricating oil and if rigid inspections are not set up to detect this condition, usually results in loss of crankshaft or damage to the engine. These items are the manufacturer's responsibility and whether or not this difficulty has been totally corrected, remains to be seen. The design of the exhaust manifold studs protruding into the water jacket is basically unsound.

Water leaks are encountered on almost all types of diesel engines. On the Type 244B engines water leaks develop between the cylinder heads and liners at the rubber water grommets around the two water outlets from the liner to the cylinder heads. These rubber seals become hard and deteriorate due to their inability to withstand the normal operating temperature of the diesel engines. To overcome this difficulty it will be necessary for the engine builder to manufacture these seals from an improved material—probably silicone seals would be the answer.

Some difficulty has been experienced with cracked heads resulting in water leaks. It appears that this condition was brought about by improper water circulation through the core of the head and improper venting of the cooling system.

The Type V O diesel engines of the early design experienced water leaks at the liner seats in the blocks. The cylinder liners were originally designed for a loose fit in the top of the block and when the engine was under full load, resulted in excessive liner movement in relation to engine block, causing the ground joint between liner and block to leak. Building up the liner seats in the block with electric weld and remachining to accommodate latest body bound type of liners was quite costly but this modification has corrected the difficulty.

With the exception of the Type 244 and the opposed piston type road diesel engines, maintenance schedules have been set up to remove cylinder assemblies on a two-year basis for all diesel engines, without experiencing an unprohibitive amount of water leaks. The Type 244 engines are removed at each annual inspection due to other defects and engineering design changes. Recent engineering improvements of the main engine frame, the testing of cast iron pistons, better water circulation through the head and reventing of the cooling system, will probably contribute to longer piston and liner life. A few years ago we, on the Santa Fe, experienced a severe epidemic of water leaks necessitating taking engine cooling water several times enroute over a division. With proper maintenance, use of proper type, maintaining correct strength of water treatment and with the help of the locomotive builders, we have been able to eliminate water leaks and extend our cylinder assembly inspections schedules to two years. At the present time we have few reports of water leaks or engines taking water enroute and these conditions are thoroughly investigated and the cause and condition corrected.

External leaks commonly found around water supply tanks, pumps, radiators, water manifolds and various piping can readily be found by daily inspections. The majority of such defects can be corrected quickly by shop forces.

I believe it would be helpful if to take a few moments and cover the procedures followed on the Santa Fe, which have been helpful in eliminating water leaks.

The first and most important item is cooling water treatment. We use a sodium chromate water treatment, maintaining a 3 percent solution in the Alco and Fairbanks-Morse road locomotives and a 1 percent solution in other locomotives. In most road locomotives this treatment is used with distilled water. The comparator system is used for periodic checking treatment strength of the engine cooling water.

To help detect internal as well as external water leaks one should first establish a predetermined water level that the engine can be efficiently and safely operated on and then maintain that water level at all times. If this practice is followed and a locomotive arrives with a marked drop in water level, a close inspection is made to determine and correct the cause of water loss.

Proper maintenance is important in the elimination of water leaks. When a locomotive arrives at assigned maintenance terminals, a small amount of lubricating oil is drained from the crankcase sump each trip and if any traces of water are found, the engine is inspected for water leaks and the condition corrected, the lubricating oil is drained, main and connecting rod bearing removed and inspected. After existing defects are repaired the engine is load tested and inspected for additional water leaks. If reports are received on an engine losing water or water being added enroute, the engine is also load-tested and the defect found and corrected. When it is necessary to change a defective cylinder assembly, the foreman in charge must make a personal inspection of the air box, liner seats, cylinder head seats and the exhaust chamber for cleanliness and defects after the assembly has been removed and OK's the block and new cylinder assembly before application. On the next trip inspection, the rocker arms are removed and the cylinder head and crab nuts are tightened to proper torque values. When all cylinder assemblies are renewed, the cylinder head and crab nuts are tightened to proper torque values and the engine given a full load test for four hours and the rocker arms removed and the cylinder assemblies re-tightened. When the locomotive returns from its first trip, the rocker arms are again removed and the assemblies are re-tightened. Each quarterly inspection, all rocker arm assemblies are removed and the cylinder head and crab nuts checked and tightened to the proper torque values on all diesel engines. We feel that cleanliness, proper supervision, proper inspection, application, and the correct procedures of re-tightening the cylinder assemblies are very essential.

Oil Leaks

The maintaining of all types of diesel engines free of miscellaneous lubricating oil leaks is a major problem. This problem is more than a maintenance item and will require design changes and improved gasket materials before they can be entirely eliminated.

Oil leaks exist between the crankcase and oil pans, around the various housings and cylinder head covers. Some progress has been made toward correction by creating a vacuum on the crankcases by various devices, use of different gaskets materials, application of additional bolts and strengthening devices to the housings has helped to some extent. Re-tightening crankcase to oil pan bolts at certain inspection periods, has contributed little if any in stopping the seepage of oil leaks at the oil pan joint.

We have applied some special bolts in this application whereby we attempt to inject sealing compound into the joint internally. However, the material would not stand up and would last, possibly one trip.

Tests are being made on various gasket materials and sealing compounds made of silicone and plastic. These tests have not accumulated enough data to venture an opinion on their merits at this time.

At the present there is no permanent solution for oil leaks and it will be necessary to maintain engines to the best of our ability to eliminate this costly defect. It will be necessary to completely dismantle the Diesel engines and apply new gaskets when oil leaks exist and it is not possible to set up a maintenance schedule doing this work on a mileage or time basis. The builders have an important responsibility in this matter and should furnish us with the correct materials and design changes necessary to correct this condition as we are being severely criticized regarding the oil leaks.

On the Santa Fe oil dams have been applied consisting of strips of cold rolled steel welded to the floor surrounding the main engine, generator, air compressors, etc., as needed. This has confined oil within a certain area and has eliminated safety hazards. It has not fixed any oil leaks. We also wipe up engine rooms when locomotives pass through intermediate terminals where locomotives operate on extended runs. This has brought about a clean and attractive engine room. However, it is costly to the railroad.

Water and oil leaks are not altogether a maintenance problem, as we have been led to believe. The railroads have done much toward correction by proper maintenance, use of the proper materials and working closely with the engine builders. It is now reaching a point where the railroads have done all that is humanly possible toward the correction of water and oil leaks and it is the responsibility of the engine builders to correct the design of the diesel engines so that they can be properly maintained free of water and oil leaks with a reasonable amount of proper maintenance.

The above is one part of a report presented by a committee of which L. L. Luthey, general supervisor of diesel engines, A. T. & S. F., was chairman.

Wayside Servicing Facilities

It is just as important to locate and design adequate wayside facilities as it is to install a large plant for maintenance and servicing of locomotives.

The points that must be given consideration before the proper arrangement can be planned are (1) the number and type of locomotive units to be serviced (2) location and the effect on the proposed layout of the expanded use of diesel locomotives or the complete dieselization of a railroad.

It must be considered that steam facilities may be completely abandoned in the future and that consequently they may not have too important a bearing on the location of the wayside facilities.

An important factor in selecting the location for the wayside facilities is that the locomotive should remain close to the point where it is operating. The large initial investment as well as potential earning power makes it imperative that the time spent in a moving locomotive to or from the servicing point should be held to a minimum.

In large industrial areas where there may be considerable switching or short movements, it may be well to consider a mobile servicing unit that can be dispatched from a main terminal point.

For this purpose, two types of units can be secured. One is an autocar that has proven successful on several railroads. The second is a refueling car that could be dispatched in the same manner.

The autocar provides a system of refueling and resanding diesel locomotives without requiring them to be brought into terminals or other fixed location service stations. They could operate in fleets of two or more and cover three points of two diesels each or five or six points of one diesel each in a radius of approximately 10 miles every third day. There are many

possibilities with this truck and it eliminates the necessity of a large number of small servicing points and an increase in personnel to operate them.

With the refueling car the possibilities are the same as with the autocar but it can cover a much larger radius with longer intervals of time. The capacities of this car are greater and it can be used on a more permanent location basis but still mobile if situations require a change in location periodically.

Cars could be dispatched in fleets from a main terminal point and inventory in oil disbursements controlled as required.

In long road freight or passenger service where formerly the locomotive was cut off from the train and moved to a servicing point, either of the cars permit spotting them in the location where the through train could be stopped and in a short time be on its way.

At a large wayside servicing point the facilities should provide sufficient storage for at least a 30-day supply of fuel oil. The fuel oil should be filtered and metered with adaptable quick operating couplings and connections.

An accompanying drawing shows a refueling package unit developed for the Reading by a Philadelphia firm.

The unit is an all-welded steel cabinet built on an angle-iron frame and mounted on a channel base measuring 5 ft. high by 5 ft. wide by 3 ft. deep.

The equipment inside includes an 85-100 g.p.m. self-priming centrifugal pump with a 7½ hp. motor or a rotary positive displacement pump with a 5 hp. motor; a pipe line strainer to protect the pump; a removable cartridge filter; a rotary meter with large numeral register and ticket printer to record the number of gallons delivered with a prefix and a suffix to indentify the location and type of oil (the meter can be provided with a set-stop mechanism that can be used to handle the oil in exact amounts); ball-bearing hose reel; 50 ft. of 1½ in. synthetic hose, quick operating nozzle; cam operated quick coupling; aluminum filter; explosion-proof light and motor starting equipment with push button control and door actuated switch. Piping and valves permit pumping from tank car to storage tank or storage tank to diesels or tank car to diesels.

Estimate and Requirements

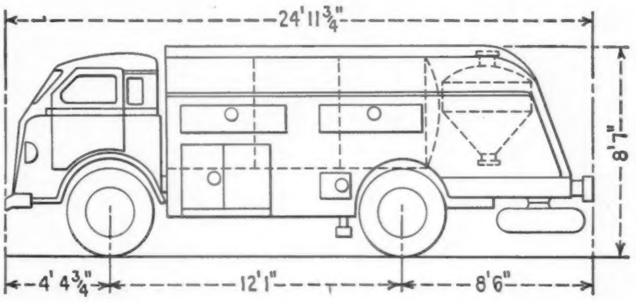
When capacities are figured for storage at various points it is comparatively safe to use 6 gallons per hour for 1,000 hp. switchers or less and 8 gallons per hour for 1,600 hp. switchers. For road diesels the basis can be on 2½ to 3 gallons per mile.

Storage tanks should be constructed in accordance with American Petroleum Institute or National Board of Fire Underwriters specifications and be surrounded with a concrete or earth dike, especially if near streams or other property, as a safety measure.

Sanding facilities usually consist of a sand tower in 3-ton, 5-ton or 10-ton capacities with hose connections to service all types of diesels.

Investigation may prove that the sand could be purchased much cheaper dried and cleaned than the wet sand could be processed through a dryer, especially at a small point. If so, it should be transported in a converted cement car and dumped in a bin and conveyed to a dry storage bin.

However, if personnel is available, an automatic oil burning



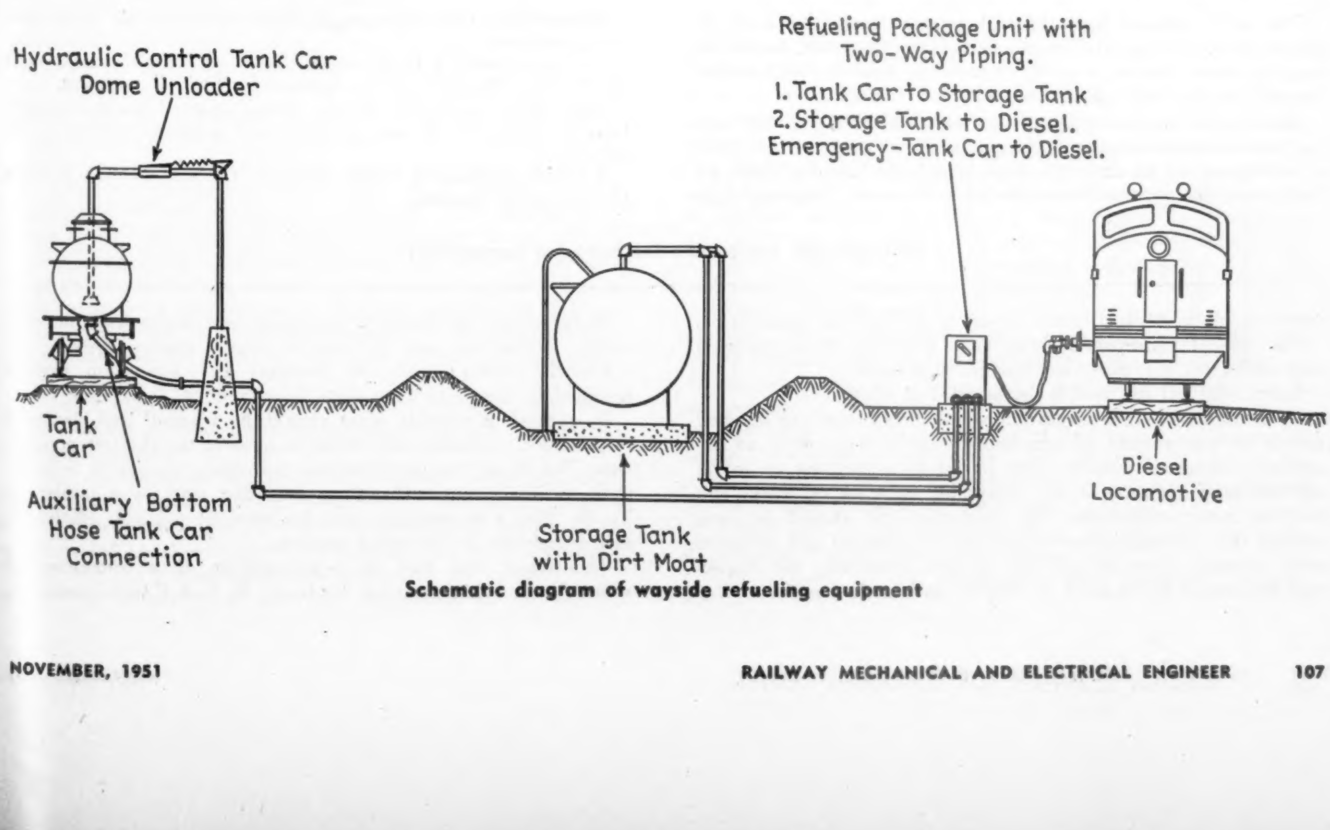
Fuel oil capacity, gal.	1,500
Sand capacity, lb.	2,000
Rate of refueling, g.p.m.	50
Rate of sanding, lb. per min.	100
Gross weight, lb.	30,000
Wheel Base, in.	145
Front Axle load, lb.	10,000
Rear Axle load, lb.	19,996
To conform with 18,000-lb. capacity in some states:	
Oil capacity, gal.	1,230
Rear axle load, lb.	18,000

Oil is pumped from the tank by a power take-off from the truck engine, using equipment similar to that employed on household oil delivery trucks.

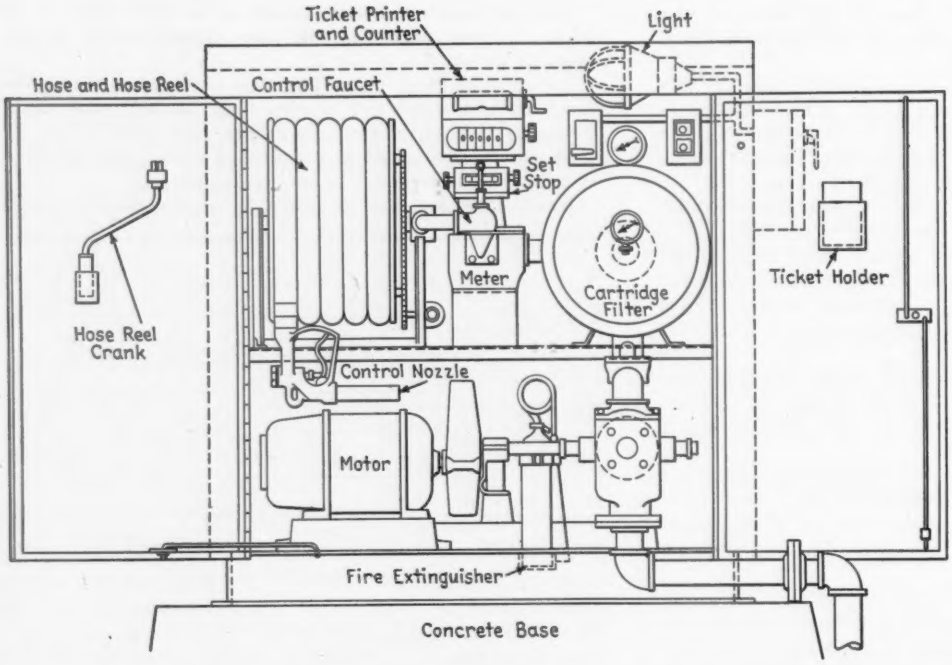
Sand is fed by gravity into a pressurized chamber conical hopper, and is blown into the discharge line by an air jet at the point of discharge. An air dryer has been introduced into the intake air line to prevent moisture being carried to the sand. Compressed air is obtained by connection to the brake pipe on the locomotive being serviced.

The service truck is equipped with cabinets for lubricants.

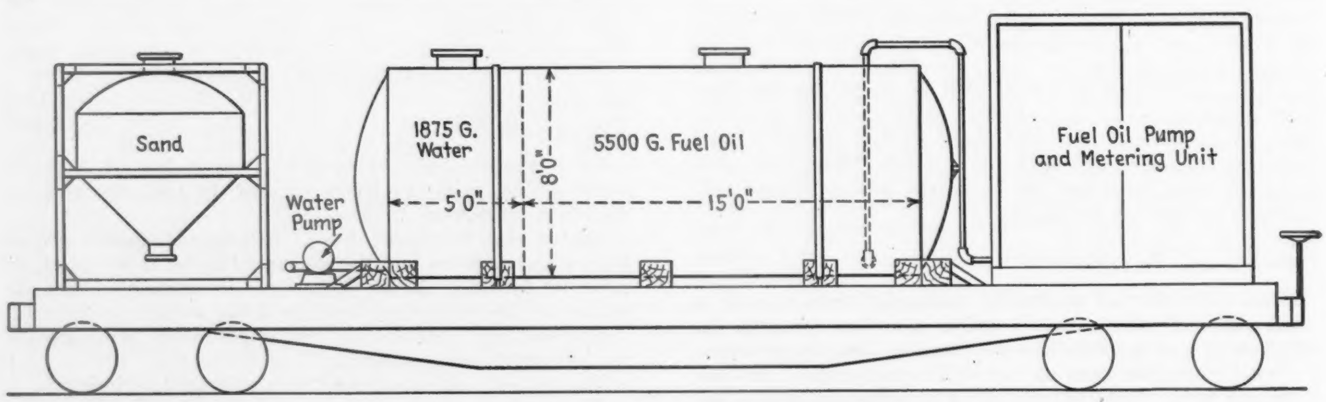
Automotive type refueling and servicing truck for highway operation



Schematic diagram of wayside refueling equipment



Diesel refueling unit as developed for the Reading



Fuel oil capacity, gal.	5,500
Sand capacity, lb.	4,000
Rate of refueling, g.p.m.	90
Rate of sanding, lb. per min.	100
Water capacity, gal.	1,875
Rate of water, g.p.m.	50

1—50-gal. lube oil drum
1— 5-gal. lube oil filler
1—box of tools
1—hinged ladder

The oil is pumped from the tank by a pump in the diesel refueler. Power to operate pump can be from an outlet located at a point where the car is assigned or from a small diesel engine mouned in the back of the refueler.

Sand is fed by gravity into a conical pressurized chamber hopper, and is blown into the discharge line by an air jet at the point of discharge. An air dryer has been introduced into the intake air line to prevent moisture being carried to the sand. Compressed air is obtained by connection to the brake pipe on the locomotive being serviced.

Water is pumped by a motor driver centrifugal pump with power from the same source as used for fuel oil pumping.

Lube oil is handled in 50-gal. drums mounted on saddles and handled with a 5-gal. can provided with a special nozzle to fill diesels.

A ladder is mounted on the car with hinges to position it when the car is on location.

Rail car and equipment for servicing locomotives

dryer could be utilized, since a supply of fuel oil is available.

The use of conveyors reduces sand handling to a minimum and eliminates the costly expense of hand labor.

Lubricating oil can readily be handled in drums.

At locations where a large number of locomotives are handled and a certain amount of emergency repairs performed, an inspection pit on an outside track or inside a building in colder sections of the country is very desireable for work on trucks and traction motor equipment. The inspection pit should be long enough for a complete locomotive, be well drained and provided with adequate lights in pits and outside. Preferably the inspection pit should be enclosed or covered with a shed roof.

Water should be available for steam heat boiler used on passenger locomotives and make-up in engine cooling system.

Electric outlets should be provided and immersion heaters installed in diesels to keep units from freezing in extreme cold.

In general, a wayside plant should be planned and designed to receive a locomotive and dispatch same in the shortest possible time. The diesel has presented the railroads a chance to increase their available time and reduce detention time to a minimum. To do this, a locomotive must be serviced quickly, efficiently, and completely in the safest manner.

This report was part of a presentation of a committee of which H. E. Niksch, master mechanic, E. J. & E. was chairman.

Today's Mechanical Problems

In address at the president's luncheon J. M. Budd discussed hot boxes, materials situation, and manpower problem

J. M. Budd, president, Great Northern, in making the principal address before the coordinated luncheon on the second day of the meeting directed his remarks at three outstanding mechanical problems: hot boxes, diesel fuel and the materials situation and, in the discussion of these said, in part, as follows:

"Of all the purely mechanical problems of railway operation today the hot box situation is the most serious—an evaluation that, I am confident, no informed person will challenge. The operation of freight trains at higher average speeds, with higher average loads per car, and at greater distances between stops has increased the incidence of the hot box.

"The days and miles of car service lost because of hot boxes is appalling. Even though journal box packing specifications were altered effective January 1 of this year as a result of the action of the A.A.R. General Mechanical Committee, and the journal box repack dates advanced to a 12 month period and A.A.R. inspection forces increased to more vigorously patrol and enforce the rules and practices pertaining to journal box care, there has not been an appreciable improvement in the overall freight car journal box performance record. For the first 6 months of this year the number of freight car miles run per hot box for cars set out between terminals averaged 175,520 miles, with 98,076 freight train cars being set out of trains between division terminals on this account.

"That individual lines must become more vigilant in the servicing of journal bearings in addition to revising and strengthening rules and practices to permit proper attention to journals prior to departure of freight trains is, I believe, obvious. But, that is not and cannot be the whole or acceptable answer to the problem.

"A marked reduction in the incidence of the hot box can be achieved only after determination of the major contributing reasons for the increase; and, I am completely confident that the mechanical officers and their staffs on most railways already are giving the situation substantial attention. The hot box problem is not, in my opinion, a condition for the sole concern of the railway industry. The railway supply field must share the responsibility for development of a workable remedy.

"Another situation of growing concern to railway mechanical departments and builders involves the diesel locomotive, and is a development of the nation's defense program. The wide use of diesel motive power has placed the railways generally on an oil economy, and so long as the proper or ideal fuels are available, combustion and attendant problems are not of great consequence.

"However, the increasingly large appetite of the defense program for refined petroleum products must be of concern to both railways and builders of diesel motive power. Not enough information is available as to the quality of fuel that can be utilized for diesel operation. Like all machines, the diesel has limitations; so we should be conducting tests, individually, and in collaboration with the locomotive builders and the oil industry toward development of factual information on what changes would be necessary should railways be forced to use fuels of lower quality than at present.

"A third subject for comment and consideration is one with which everyone in this room is unpleasantly familiar—the critical materials situation.

"What has happened to the railway industry in the allocation of sufficient materials, steel particularly, for the construction of new cars and locomotives, and the maintenance of equipment in use, thus far has been thoroughly disheartening and unjustified. Considering the repeated acknowledgments of the railways' vital role in the defense effort and their importance to the efficient handling of their domestic responsibilities, their treatment to date in materials allocations has led to the reasonable suspicion that we have been kissed on one side and kicked on the other.

"A question which presents itself is whether or not critical materials deliberately have been withheld from the railways and, if so, for what purpose.

"Whatever the answer to that question, the condition exists. While we can only pray the condition will improve, it necessitates the greatest possible economy of every pound of critical metal and other materials in every railway shop in the country. Keeping in service parts that are safe although somewhat worn is one recommended contribution to licking the materials shortage. Another is increased salvaging of useful parts from dismantled equipment. And, experimentation with substitute materials could be stepped up.

"I am not assuming, of course, that economy of hard-to-get materials is being overlooked, but, I feel that something can be gained by emphasizing at this time the necessity for a more intense, far-reaching program of conservation of critical materials, machines and tools. Education of shopmen is the keystone of successful economy, and I am positive that the leadership of mechanical officers and their supervisory forces in a program of planned conservation would be impressively productive.

"It also is recommended that mechanical departments consider continued standardization of design of passenger cars and other rolling stock. Designs which will decrease the incidence of corrosion are of particular value and emphasis, for the corroding of metal is, as everyone here knows, a major contributor to deterioration of equipment and adding materially to maintenance and repair expense. Much headway has been gained by mechanical departments in combatting this problem, but I am sure that none will disagree with the statement that much remains to be done.

"Another subject for your consideration is the manpower problem in railway mechanical departments and others identified with operations. The continuing loss of young men to military services through selective service or voluntary enlistments induced by the draft, is creating difficulties with which you are aware.

"The age factor is a vital one in training of young men for jobs in the mechanical departments of railways, and present laws are not helpful to training programs. The present draft laws reduce the availability of young men within the apprentice age limits, and that seriously cripples training programs involving the handling and maintenance of modern railway equipment.

"Closest attention to the manpower situation and its relationship to employe training and military requirements is of constant necessity; and, in addition, we must continue to insist at every opportunity that railways be given equal consideration with other industries in the availability of manpower.

"'Cost' is a vital word today and in the future of the railway industry. Without sacrificing, but preferably with an improvement in the quality of our product, we must find ways of reducing our manufacturing costs. One of our large items of cost is the maintenance of equipment.

"New ideas . . . new methods . . . new tools . . . new metallurgical developments will come. We will have to venture into uncharted waters at times; but we must go forward, for standing still is as bad, if not worse, than going backward.

"I leave with you this question: 'What will the next generation of railwaymen inherit from their predecessors?'

"The answer to that question is this generation's responsibility!"

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H. H. Urbach, general superintendent motive power and machinery, C.B. & Q.

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J. S. Swan, supervisor locomotive operation, L. & N.

C. R. Patterson, fuel supervisor, Canadian National

Electrical Sections Hold Joint Sessions And Meet With L.M.O.A.

Addresses, reports and discussions indicate that railroads are now trying to perform a big electrical maintenance job with too few facilities and inadequately trained personnel

THE annual joint meeting of the two A.A.R. Electrical Sections was called to order in the Hotel La Salle, Chicago, on Monday, September 17, 1951 by Chairman (*Electrical Section, Engineering Division*) H. F. Finnemore, chief electrical engineer, Canadian National. Having welcomed members and guests, Mr. Finnemore spoke of the proposed joining of the two sections. He said that both groups had endorsed the consolidation and that the subject was now before the Board of Directors of the A.A.R. for final approval. It calls for a complete new section and the employment of a full-time secretary. In view of the situation in the railroad industry, he emphasized the importance of increasing the membership of the sections by bringing in younger men.

Chairman (*Electrical Section, Mechanical Division*) L. C. Bowes, electrical engineer, Chicago, Rock Island & Pacific, said the reports represent much time and effort that the least the members present could do was to participate in discussion. He laid stress on the responsibility of electrical departments and said the air conditioning of passenger cars alone had doubled electrical maintenance, while diesel locomotives had multiplied it several times. Most of the equipment, he said, is highly specialized and requires much in the way of carefully selected and trained men. He concluded by saying: "Recognize your responsibility when you are called upon to be a member of a committee."

Election of Officers

Officers elected by the Electrical Section, Mechanical Division, were as follows:

Chairman: H. C. Paige, assistant mechanical engineer, New York, New Haven & Hartford.

Vice-Chairman: R. I. Fort, assistant research engineer, Illinois Central.

Second Vice-Chairman: C. W. Nelson, electrical engineer, Chesapeake & Ohio.

Members, Committee of Direction: P. H. Verd, superintendent of motive power and equipment, Elgin, Joliet & Eastern, and E. J. Feasey, general supervisor diesel equipment, Canadian National.

Officers for the Electrical Section, Mechanical Division, will be elected by letter ballot.

Wire, Cable and Insulating Materials

The report of the Joint Committee on Wire, Cable and Insulating Materials was presented by Committee Chairman C. R. Troop, assistant engineer, New York Central. The major part of the report consists of five specifications respectively, for: (1) Rubber insulated braided cable for train lighting and air conditioning service; (2) Rubber-insulated polychloroprene sheathed cable for train lighting and air conditioning; (3) Multiple-conductor, extra flexible portable cable for air conditioning and battery charging; (4) Single-conductor, varnished cambric-insulated, 0-1,000-volt, braided cable; and (5) Single- and multiple conductor varnished cambric-insulated, lead-covered cable.

The report was submitted by a committee of which C. R. Troop, assistant engineer, New York Central was chairman.

Discussion

C. A. Williamson (T. & N. O.) asked if the choice of strand size in the specifications had been made because of limitations created by critical material. Chairman Troop (I. C.) said, No, that the 7-strand wire is considered sufficient, but that 19-strand wire is okay if the user prefers. Roy Liston (A. T. & S. F.) said he believed that nearly all roads use 19-strand wire, and expressed the opinion that it should be included in the specification.

W. S. H. Hamilton (N. Y. C.) asked if others had used solid neoprene-insulated wire for control circuits and Mr. Liston replied that he had made tests with the aid of the DuPont Company with results so satisfactory that on the Santa Fe they use it exclusively when it can be obtained. He added that most of the wire they are now using is neoprene-sheathed, but that solid neoprene wire would be satisfactory if available. K. H. Gordon (P. R. R.) reported some trouble caused by the damaging of neoprene insulation in rough conduit. Mr. Liston reported that fuel oil will damage neoprene, but that it is not affected by other oils. To this Mr. Hamilton replied that he had observed some swelling of neoprene in contact with fuel oil, but had never seen any evidence of failure from this cause. S. R. Negley (Reading) suggested that further information on this subject be obtained from the manufacturers.

Electrical Section—Engineering Division

Association of American Railroads

Officers

H. F. Finnemore, *Chairman*, chief electrical engineer, Canadian National, Montreal, Que., Canada

C. A. Williamson, *Vice Chairman*, electrical engineer, Texas & New Orleans, Houston, Texas

N. D. Howard, *Secretary*, Electrical Section, Engineering Division, A. A. R., Chicago

H. F. Finnemore

N. D. Howard

C. A. Williamson

Power Supply

The report of the Joint Committee on Power Supply covers six assignments, as follows:

1. Power Supply for Engine Terminal Facilities, Including Special requirements for Diesel Locomotives

By R. H. Herman

The use of lights in a diesel locomotive cab for illumination while the locomotive is in the shop for repairs or during layover time at terminals results in a serious drain on the battery. This is particularly true if the layover time is long, the engine is not operated, and the battery is in poor condition. The battery may be drained to such an extent that it does not have capacity to start the engine, with consequent delays until it can be recharged.

Lighting on most diesel locomotive units is supplied from the 32-cell battery at 64-vots d.c. If a.c. energy is to be supplied direct from the shop distribution system, it would be necessary to install completely independent systems in each shop operating at 64 volts. Inasmuch as practically all diesel shops now have a 115-volt, single-phase circuit with receptacles at convenient points for extension cords and electric tools, it is more desirable to install stepdown transformers on the locomotive units themselves to operate from a nominal 115-volt source.

The equipment required on the locomotive is covered on pages ES-G-38 and 39-1947 of the Manual, Electrical Section. Mechanical Division, and consists of the following:

(1) A 1 ½ kva., 60-cycle, single-phase, air-cooled transformer. 115/230-volt primary, 75-volt secondary, with full capacity tap at 60 volts, and with primary windings connected to operate from a nominal 115-volt source of power.

(2) A double-pole double-throw switch with circuits on the locomotive arranged to permit connecting the lighting circuits either to the power supply on the locomotive or to outside supply through the transformer.

(3) Two receptacles on each locomotive unit, one on each side, located under the cab frame. The receptacles shall be 30-amp. capacity with three male contacts, the bottom contact to be grounded through the jumper cable. Receptacle housing to be insulated from base to prevent excessive current in ground wire due to potential differences in electrified territory.

(4) The recommended plug, as well as the receptacle, is shown on page ES-G-39-1947 of the Manual.

It is desirable that the double-throw switch be located and connections made adjacent to the lamp regulator so that all lighting, including headlight, classification lights, gage lights, etc., will be energized. This will facilitate detection of burned-out lamps by electrical inspectors.

The general arrangement of the shop distribution system, location of receptacles and panelboards, and whether power source is 115/230-volt, 3-wire, 115-volt, 2-wire, or 120/208-volt, 4-wire grounded neutral, will depend upon conditions at the particular shop.

In a typical installation on a large eastern railroad, energy is distributed to circuit-breaker type panelboards at convenient locations by 4-wire, 3-phase, 120/208-volt grounded neutral service. Each panelboard controls five circuits, each with a 35-amp., single-pole breaker and solid neutral. All wire between panelboard and receptacles is No. 8 insulated wire.

Two receptacles in a common box are located on columns under the working platforms, 28 ft. apart, to serve the working tracks on each side. Each 35-amp. circuit from the panelboard supplied two receptacles, but not the two receptacles at the same location. For example, the first two receptacles may be on circuits 1 and 2, the next two on circuits 1 and 3, and the last two on circuits 4 and 5. In the same manner, circuits 1 and 4 may be on phase A, circuits 2 and 5 on phase B, and circuit 3 on phase C. With this arrangement, satisfactory operation is secured by using No. 8 wire, single neutral, and the load is divided between phases.

In diesel shops with more than two tracks it will be necessary to provide receptacles and a distribution system under the working platforms between every other track.

The receptacles to be used in the shop installation should be 30-amp. capacity, 3-pole, grounded through the shell and extra pole. Portable cables should be of sufficient length and equipped with plugs on the one end to suit the receptacle on the locomotive and on the other end to suit the shop receptacle.

Fig. 1—One of the new 100-amp. double receptacles and the metal housing

2. Standardization of Plugs and Receptacles

By G. L. Sealey

The manufacturers of wayside receptacles and plugs for pre-cooling facilities and battery charging advise that the use of circuit-breaker wayside receptacles is continually increasing and that this type receptacle has been used in the majority of the larger installations which have been made in the past year.

The majority of the breakers are equipped with trip units of the magnetic type, which eliminate trouble previously experienced with the thermal magnetic types when they are exposed to the heat of the sun.

Insulated plugs of bakelite and rubber construction are used in the majority of intallations in preference to the metal plugs, and the use of the "Snap-out" safety adapter is increasing.

One manufacturer has introduced a metal nut and anti-friction washer which is placed on the end of the bakelite plug as a protective measure where plugs are hammered into the car or wayside receptacles. Another manufacturer has introduced a right-angle battery charging plug for use where space between car receptacle and platform is limited. This manufacturer claims that this plug has the advantage that it can be inserted in the receptacle where the longer, straight-type connector cannot be readily inserted.

3. Yard Electrical Distribution System At the Birmingham, Ala., Terminal

By H. A. Hudson

Because of the increasing number of new streamlined passenger cars being operated through the Birmingham Terminal Station, Birmingham, Ala., it was necessary for the Terminal Company, early in 1950, to replace the original yard electrical distribution system for station tracks with a layout having sufficient capacity to operate the 25-hp. standby motors on the new passenger equipment and the 10-hp. motors on the mechanically activated air-conditioned Pullman cars.

The original installation consisted of a limited number of 60-amp., yard receptacles with a 240-volt, 3-phase distribution system, which was fed from a power service located a considerable distance from the yard receptacles. Therefore, in order to provide ample capacity for anticipated loads and to secure the operating advantages of more conveniently located yard receptacles, it was decided to replace the original facilities with an entirely new system.

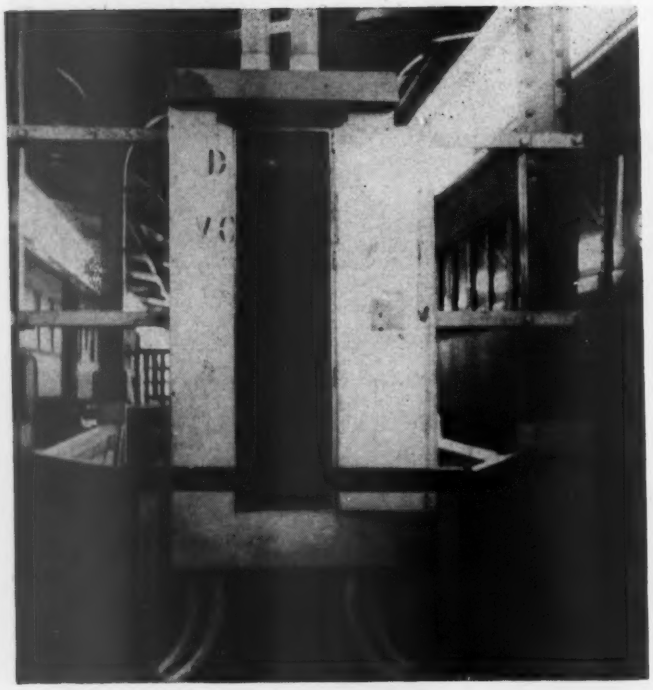
The new installation includes thirty, 100-amp., 4-pole double receptacles and 10 of the original 60-amp., double receptacles. (A yard layout included in the report is not reproduced here because of its size.) The 100-amp. receptacles are equipped with 100-amp. breakers, with a reset button on the outside of the receptacle housing. Fig. 1 shows one of the new 110-amp. double receptacles and the metal housing. Type G, Super Service 3-conductor No. 4/A.W.G. cable is used for the portable cords for connecting the cars to the yard receptacles. This cable has three ground wires made up with fillers. Standard 8-ft. Copperweld ground rods were installed at each yard receptacle. Therefore, the ground wire in the portable cords insures that all cars are effectively grounded when connected to the 240-volt distribution system.

At a point near the center of the load, a steel cabinet with six 400-amp. industrial breakers was installed under one of the platform sheds. The receptacles are divided into six groups, and each group is connected to one of the 400-amp. breakers in the switching cabinet. The grouping is so arranged that all of the cars of any one train will not be connected to one circuit. This prevents a possible overload in case a train with a larger number of 25-hp. cars is being serviced on one track. Fig. 2 shows a front view of the switch cabinet.

The undergound cable used between the main switch cabinet and the yard receptacles is 3-conductor, 500m.c.m., with a neoprene jacket. Smaller cable is retained on some of the 60-amp. receptacles which were not disturbed by the new installation and left at secondary locations.

To provide a power supply near the center of the load and thereby avoid excessive voltage drop, a transformer station, consisting of three 167-kva. transformers, was erected above one of the platform sheds near the main switch. Because some wood is used in the shed construction, and to avoid a possible fire hazard in the event of an explosion in a conventional oil-filled transformer, askarel-filled transformers were used. The primary windings of these transformers have a rating of 13.2 kv., and the secondary windings, 240 volts. Fig. 3 shows a view of the transformer station.

The main service from the power company which supplies the entire terminal is a 13.2 kv. closed delta system. The service point is located approximately 700 ft. from the transformer station, over the platform shed. Thus, it was necessary to extend the 13.2 kv. service line for this distance. On account of tracks, sheds and other obstructions, it was impracticable to install an open-wire distribution line for this service. Therefore, a 3-conductor, No. 4 A.W.G., 15,000-volt aerial cable, with ambrac tape and asbestos braid, was installed for the tie line between the transformer station over the shed and the main power service. This cable was suspended on a ⅜-in. Copperweld messenger wire. The cable was terminated at both ends by means of type F



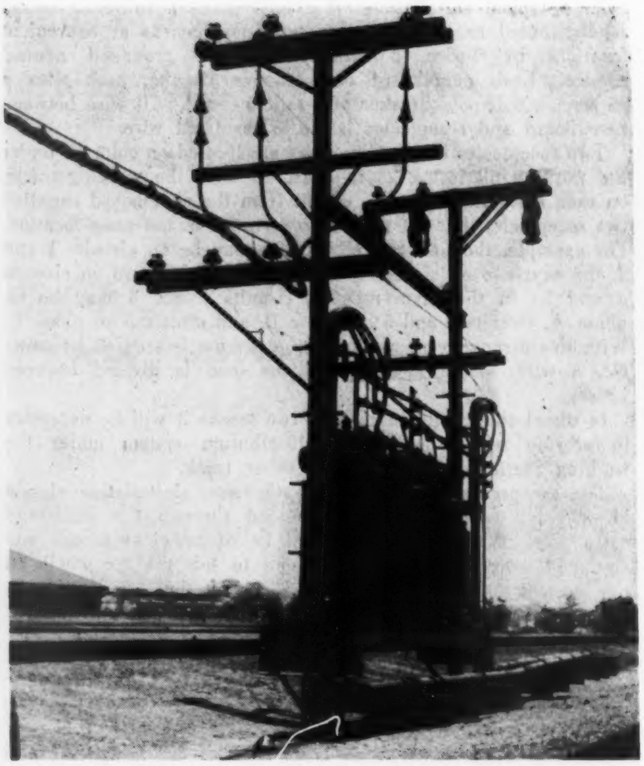


Fig. 2 (Left)—Front view of switch cabinet. Fig. 3 (Right)—Transformer station, erected above one of the platform sheds

shields. Two shields per conductor were used to prevent possible leakage in the event cinders or smoke settle on the shield.

4. A. C. Standby Distribution System At the Washington, D.C., Terminal

By R. E. Hauss

The Washington Terminal, like other terminals, was faced with the problems of servicing cars with large motor-generator sets. In order to provide suitable service, they have installed 100-amp., 240-volt outlets with built-in circuit breaker on 80-ft. spacing along each track in the passenger station. Since there are 20 tracks on the upper level and 10 on the lower level, the magnitude of this installation can be readily seen.

The existing 60 and 100-amp. fused single receptacles were replaced by 100-amp., duplex circuit-breaker type receptacles where there are double tracks between platforms. This is illustrated in Fig. 1. The concrete box on which the receptacle is sitting is hollow and serves as a junction box. This concrete box, in turn, is bolted to a concrete pedestal in which potheads are used to seal off trench lay cable. The old outlet can be seen to left of box.

On single tracks, due to insufficient clearance, 100-amp. single circuit-breaker receptacles are recessed into the side of the platform, as illustrated in Fig. 2.

The old fused receptacle box can be seen just to right of the new receptacle.

There are seven transformer stations in this area. Of these, three are new installations. Three of the vaults are at the south end of the station tracks in the tunnel area, two are on the lower level, and one is in the passage below the upper level. The other four are at the north end of the station.

The distribution to these transformer stations from substation is 2,300-volt, 3-phase, 60-cycle, delta. The disconnects at the transformers are electrically interlocked with circuit breakers in substation so that it is impossible to open disconnects with the line hot.

Fig. 1—Where there are double tracks between platforms, the existing 60 and 100-amp. fused single receptacles were replaced by 100-amp. duplex circuit-breaker type receptacles

Fig. 2—On single tracks, the 100-amp., single circuit-breaker receptacles were recessed into the side of the platform

The 240-volt secondary lines from the transformers on the east side, upper level, are in Transite ducts atop the wall between the upper and lower level, as shown in Figs. 3 and 4. Since the individual circuits drop off at 80-ft. intervals under ground, and loop into and out of the receptacles half way across the station tracks, no one circuit will serve more than one car in any single train. The underground cable for the most part is trench-lay cable, and is in ducts only where conduit was pushed under platforms.

The cable from the transformers on the east side of the lower level and the west side of the upper level is trench-lay cable, buried in the ground parallel to the tracks, and branches off at 80-ft. intervals under the tracks to receptacles in the same manner. The lower level was handled in the same way. Where possible, and the cable proved satisfactory, existing 4/0, 3-conductor trench-lay cable was used. Some of these lines were paralleled to get the necessary capacity. For the most part, the new cable installed is 3 single-conductor, 500 m.c.m. The remarkable part of this installation is that it was installed without interruption to train service.

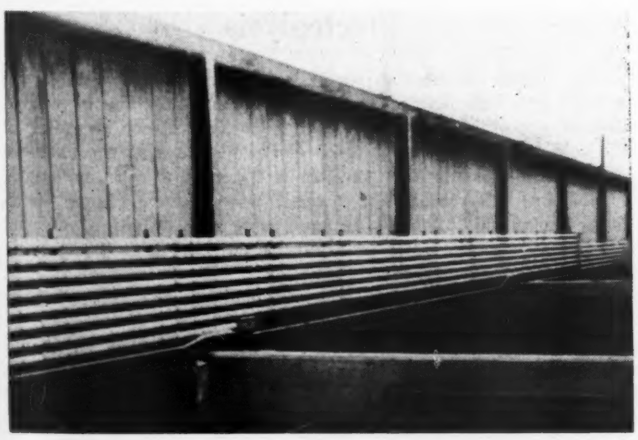


Fig. 4 (above)—Duct line along wall

5. Power Supply for Standby Facilities For Air Conditioning

By S. D. Kutner

Mott Haven yard is the coach yard for the Grand Central Terminal. It is located 5.28 miles from the terminal and lies between 149th Street on the south, 161st Street on the north, Morris Avenue on the east, and Sheridan Avenue on the west, in the borough of the Bronx, in New York City. It has an area of 1,439,044 sq. ft., and is divided into 6 sections or yards. In addition, it has a car repair section.

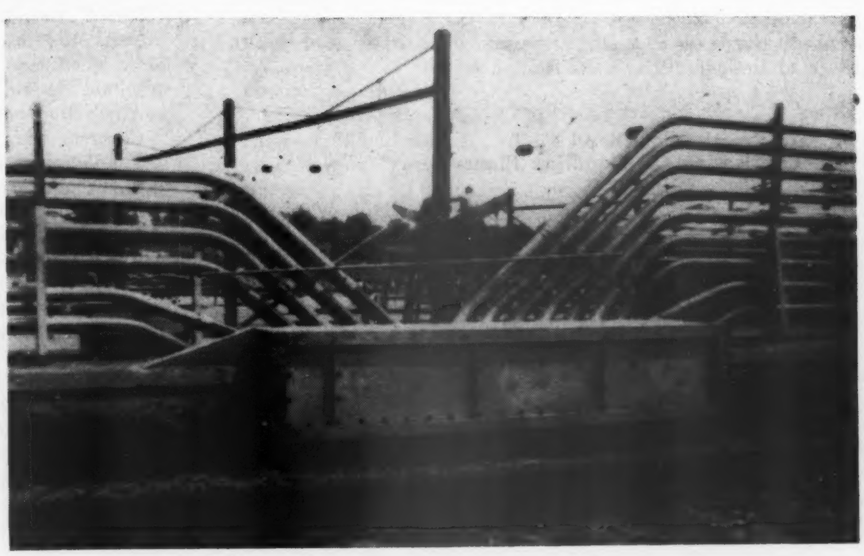


Fig. 3 (right)—Transite duct line into transformer station

These yards are designated by the following letters: A, F, J, B, W, M. Yard A has 5 short tracks and is used for storage of freight and milk cars destined for the local freight yards. Yard F has 11 tracks, and is used for the storage of cars and cut-outs. This yard has no platforms. Yards J, B and W have 18, 17 and 20 tracks, respectively, and are used for receiving and making up New York Central main-line trains. Yard M has 22 tracks and is used for making up New Haven main-line trains and some New York Central night trains. The car repair section has 7 short tracks. Only yards J, B, W and M are supplied with standby outlets.

The first major standby outlet installation for Mott Haven yard was designed in 1937 and provided 144 outlets in yards B and J, and 56 outlets in yard W. These outlets are all of the 60-amp. size.

The 1948 layout increased the number of outlets to the following totals, and in addition, provided service in yard M; 156 outlets in yards B and J, 71 outlets in yard W, and 96 in yard M. These outlets were all of the 100-amp. size.

The 1948 improvement program called for increasing all existing circuit breakers to 100-amp. capacity and wiring to minimize voltage drop as well as I^2R loss. Feeds were run at right angles to the tracks to diversify power loading of the main feeders. Four-wire, 3-phase, 60-cycle, 208-volt power is taken from the Consolidated Edison Company at the northeast and northwest ends of the yard.

At the northwest end of the yard, the service is split into two feeders, each rated 2,000 amp., and each of these is further reduced to two feeders, each of 1,000-amp. capacity. These, in turn, supply 350-kva., 3-phase, oil-cooled outdoor-type auto-transformers, which step the voltage up to 240 volts. The service from the auto-transformers is protected by main circuit breakers of 1,000-amp. capacity which serve the switchboard busses.

The switchboard busses are arranged in multiple, forming two groups, thus, permitting the greatest flexibility in the event of the failure of any component. The switchboard distribution breakers, 24 in number, up to 400-amp. capacity, serve branch circuit panelboards located at strategic points in the various yards, and here individual breakers of 100-amp. capacity serve each individual outlet.

At the northeast end of the yard, for mechanical reasons and because of space limitations, the 2,000-amp, service is split and serves two 350 kva., 3-phase, oil-cooled, outdoor-type auto-transformers which serve two main feeders direct to the branch circuit panels. Each branch circuit panel has main protection as well as protection for each individual outlet. Connections of panels to feeders are staggered to diversify further the feeder loading and make maximum use of the installed copper.

The entire installation was designed to minimize failures and to localize failures should they occur. Voltage drop was kept within economic limits, with 10 per cent permitted under maximum loading to the most remote point.

The new facilities can now handle 35-kw. cars without any difficulty, which was one of the major reasons for undertaking this project.

Credit for assistance in preparing this report is herewith given to Designer Otto T. C. Kettler.

6. Safe Practices in Diesel Fuel And Lubricating Oil Handling Plants

By J. W. Horine

Review of requirements has not developed any further information than that previously reported. Briefly, the rulings and regulations of local state or municipal authorities, insurance underwriters, railroad insurance departments or engineering offices govern where applicable. Where no such rulings or regulations exist, determination of class of motors and control must be based on such factors as whether the installation is outdoors (requiring weatherproof apparatus) or indoors. If indoors, factors such as ventilation, temperature of oil handled, presence of fumes, etc., must all be considered and that class of apparatus selected which will afford the maximum economic protection.

The committee recommends that this assignment be carried over another year. A questionnaire will be sent to member roads requesting information relating to various governing rules and regulations, and also the practices of the member roads.

The report was submitted by a committee of which C. P. Trueax, assistant electrical engineer, Illinois Central was chairman.

Discussion

C. A. Williamson (T. & N. O.) asked if any provision had been made to protect against moisture, where cables from wayside receptacles go into the ground. H. A. Hudson (Southern) replied that cables brought up into a box are sealed with compound. Mr. Williamson added that breathing will bring moisture into the receptacle housing and that it is necessary to have a drain plug to dispose of this moisture.

Referring to the Mott Haven installation, H. F. Finnemore (C.N.) asked if the 208 volts of the network were an actual or nominal values, and asked if 208 is sufficient for operation of standby motors. W. S. H. Hamilton (N. Y. C.) said the 208 volts had been boosted to 240.

Representatives of other railroads also confirmed the fact that 208 volts is insufficient, and one reported the use of booster transformers to raise the network voltage from 208 to 240.

Asked if a 100-amp circuit breaker is sufficient for a 35-kw. m.g. set on a car, S. B. Pennel 1 (N. Y. C.) said that the largest motor used on New York Central cars is 25 hp.

Following a discussion of the snap-out safety adapter for preventing damage to portable standby power cables when cars are moved before the cable is disconnected, Mr. Williamson endorsed the device as an excellent provision.

Electrolysis

The report of the Committee on Electrolysis is notable for a brief and sufficient summary of tests made by the committee over a period of years in which a positive direct potential of 25 volts was applied to steel electrodes encased in concrete cylinders of various diameters up to 25 in., and 6 ft. in length, buried in the ground. The ground was negative. Some specimens had no potential applied, and some an alternating potential of about 40 r.m.s. volts to obtain a current value comparable to the direct current.

Conclusions and recommendations made in the report are as follows:

The passage of direct current through imbedded steel into the concrete causes corrosion of the steel, with resultant formation of iron oxides with a volume expansion of several times. The resultant expansion produces cracking of the concrete.

Stainless steel has little effect in reducing the corrosion.

Alternating current alone does not cause corrosion.

Steel in concrete with no current flow is unaffected.

Direct current flow from concrete into earth containing sulfates attracts the negative sulfate ions to the concrete surface in large quantities and produces an accelated sulfate attack with resultant deterioration.

Alternating current does not deteriorate concrete.

Concrete with no current flow is unaffected.

The deterioration of steel and concrete is prevented by stopping the flow of current. This can be accomplished by insulation of the steel by coating it with an asphalt impregnated membrane. Other coatings may also be found suitable.

The deterioration of steel and concrete is prevented by stopping the flow of current. This can be accomplished by insulation of the steel by coating it with an asphalt impregnated membrane. Other coatings may also be found suitable.

No procedure or material is known that increases the electrical resistance of the concrete appreciably or prevents its deterioration. Concrete in damp ground is a relatively good conductor. Resistance to the flow of stray currents must come from other sources than the concrete.

The report was submitted by a committee of which H. P. Wright, assistant electrical engineer, Baltimore & Ohio, was chairman.

Overhead Transmission Line and Catenary Construction

During the past year, the Committee on Overhead Transmission Line and Catenary Construction has given consideration to correcting some minor discrepancies in the areas of grooved trolley wire. An accurate check of five sizes indicated a maximum error of 0.2 per cent which is considered satisfactory. It has also worked on the development of a gage for checking the size of grooves in trolley wires.

The major part of the report is a description of a long overhead power line crossing of the Susquehanna River, near Millersburg, Pa. This is as follows:

One of the longest river-crossing power-line spans in the United States was completed over the Susquehanna River, at the top of Berry Mountain Gorge, approximately one mile south of Millersburg, Pa. The crossing span, 5,367 ft. in length, was built for operation at 66 kv. Supporting structures on each side of the river are 670 ft. above river level, and the conductors sag to within 75 ft. of the river. This site was chosen because preliminary engineering established that the entire gorge could be spanned, and thus eliminate costly construction and the hazardous location of towers on islands. Many engineering problems entered into the design of this line, namely: Types of supporting structures; type of conductors; spacing of conductors; lightning protection; and the meeting of all requirements of the Public Service Commission and the National Electrical Safety Code.

The crossing span is supported by a three-mast steel structure at each end, one conductor being attached to each mast. The masts are 14-in. wide-flange H-sections, weighing 87 lb. per ft. They are spaced on 30-ft. centers and are guyed to provide necessary longitudinal and lateral strength-requirements. Each mast is imbedded in a concrete foundation 3 ft. square, and 5½ ft. deep, to spread the downward thrust over a larger area. The masts are designed on the basis of 18,000 lb. per sq. in.,—60 L/R in compression, and 18,000 lb. per sq. in. in tension, the maximum L/R ratio being 140 on the longest mast. Each structure is supported by thirteen 21/32 in., 19-strand EHS Copperweld anchor guys, and one similar inter-mast guy, each having an ultimate strength of 37,690 lb. Two anchor guys on each mast provide the required longitudinal strength for the long span. Two side guys in each direction provide the lateral strength. Three additional guys in the direction of the long span, one on each mast, support all dead end loads in the adjacent spans.

The guys are attached to steel anchors fabricated from 8-in. channels 8 ft. long, held together with tie plates and buried 7 ft. is concrete. Guy wire ends are equipped with compression-type clevis to assure developing full strength, without slippage. The conductors used were a special Copperweld composite of 19 strands, 4 being of hard-drawn copper, and 15 of 30 per cent Copperweld steel. The conductor attachments are double-string tension assemblies using 25,000-lb. ball-and-socket type, 10 in. disc insulators, 8 units in series in each string. The two outside conductors were installed to a sag of 590 ft., and the middle conductor 560 ft., at 60 deg. F., no ice or wind load. This conductor separation at the center of the span affords an additional safeguard against swing. The center conductor is stressed to 50 per cent and the two outside conductors to 48 per cent of ultimate strength when loaded with ½-in. ice and 8-lb. wind.

Because of the high cost of erecting overhead ground wires, expulsion gaps were installed on each of the supporting and adjacent structures to drain off lightning charges. On the remainder of the line, two-pole "H" structures support the power conductors. Two overhead ground wires and a buried counterpoise provide lightning protection. In order not to interfere with traffic over two important highways and the Pennsylvania Railroad, temporary wood poles were installed close to both sides of the river. Two portable radio sets were used to provide communication between opposite sides of the river, which materially aided operations. A ½-in. hemp rope was first strung across the river. This, in turn, was replaced by a 7/16-in. plow steel cable, since the rope was not considered strong enough to pull the conductors across the gorge. Finally, the three Copperweld conductors were fastened to the steel cable and were pulled from the east shore to the west shore of the river by means of a winch-equipped line truck. Men in boats on the river were constantly on the alert to prevent the conductors from becoming snagged in the rocky river bottom. The entire wire-stringing operation, including pulling the conductors to final sag, required only four days.

The report was submitted by a committe of which E. M. Hastings, Jr., wire crossing engineer, Chesapeake & Ohio, was chairman.

Discussion

In response to a question, L. B. Curtis, (P.R.R.) said that 12 electrified railroads had been asked about a gage and several had replied that they had no use for such a gage, since they only use one size of wire and that the gage is used to check wire before it is delivered by the manufacturer. H. F. Brown (N.Y., N.H. & H.) said it would appear that a go- and no-go gage, such as that being considered, could be used only at the ends of the wire and that no one liked to cut the wire unnecessarily. He expressed the opinion that some kind of measurement should be used.

Mr. Curtis replied that the committee had investigated a gage which could be used anywhere on the wire but had found it to be impracticable to make such a precision gage without running the cost too high. K. H. Gordon (P.R.R.) said he considered a gage used at the end of the wire to be adequate since the clips are not highly accurate in size and the wire should be sufficiently similar throughout its length. Mr. Brown suggested that the railroads use the manufacturers' gages, and Mr. Curtis replied that some inspectors are not satisfied with this procedure.

Corrosion Resisting Materials

The Committee on the Application of Corrosion-Resisting Materials to Railway Electrical Construction has been on a standby basis during the past year and presented only a token report. Over a period of years, it has developed a large amount of valuable data on corrosion of metals exposed to steam locomotive exhaust gasses and salt spray. In reporting for the committee Chairman H. F. Brown said an endeavor will be made in 1951-1952 to start an investigation to determine the relative corrosive effect of diesel exhaust as compared with steam locomotive exhaust on overhead structures.

The report was submitted by a committee of which H. F. Brown, electrical engineer, New York, New Haven & Hartford, is chairman.

Protective Devices and Safety Rules

During the past year, a number of tests have been made by the Committee on Protective Devices and Safety Rules to determine some yardstick whereby resistance between tank car bodies and rails might be predetermined with the idea that some changes in the existing manual material might be desirable. To date, tests have not been conclusive and the committee has not been successful in developing sufficient information to warrant any change in existing instructions.

The report is signed by J. M. Trissal (*chairman*), assistant chief engineer, Illinois Central; S. W. Law (*vice-chairman*), signal engineer, Northern Pacific; D. M. Burckett, electrical engineer, Boston & Maine; F. J. Corporon, superintendent way and structures, Chicago, South Shore & South Bend; H. F. Finnemore, chief electrical engineer, Canadian National; S. M. Viele, assistant engineer, Pennsylvania; and R. P. Winton, testing engineer maintenance of way, Norfolk & Western.

Discussion

H. F. Brown (N.Y. N.H. & H.) asked if any electrified road had had experience with rails of a siding connected to ground near a building so that sparks might be caused by contact between the building and a car on the siding. Although no flammable materials were involved, to avoid sparking it was found necessary to isolate the siding from the main line and connect the siding rail to the building. Mr. Trissal cited similar experiences.

Electric Heating

The report of the Committee on Electric Heating covers detailed specifications for tubular type electric heaters for track switches, and these specifications were submitted by the committee for adoption to replace specifications of the same type now appearing in the Electrical Section manuel. The report also includes tables covering Pennsylvania track switch heater installations in both a.c. and d.c. territory.

The final section of the report describes film type electric heaters consisting of thermosetting electrically-conductive plastic material, first used for aircraft anti-icing applications. The heating elements can be used at temperatures up to 400 deg. F. with power input as high as 30 watts per sq. in. Applications of possible interest to railroads are oil transfer and hydraulic systems, oil storage, fluid heaters, food containers, heaters for air intakes of limited volume, railway car heating and other space heaters.

The report was submitted by a committee of which C. A. Williamson, electrical engineer, Texas & New Orleans is chairman.

Discussion

The report was presented by Chairman C. A. Williamson who called on E. B. Hager (I.C.) to present the section of the report on track switch heater specifications. Mr. Hager reported that the application of heaters was not as simple a subject as might appear. Clamping to the rail, he said, was of most importance because, if the clamps are not drawn up, the heating element will work loose, and if clamped too tight, the element will buckle. He recommended tight clamping at the center, and looser clamping at the ends, to allow for expansion. Concerning wattage, Mr. Hager said railroads express preferences for different ranges running from 275 to 500 watts per foot. The latter, he said, seems ample for the most extreme conditions in the United States.

The section of the report covering the Pennsylvania installations was presented by L. B. Curtis (P.R.R.). He said plans had been made to make tests with heavy snow and wind.

Chairman Williamson presented the section of the report on film type heaters. W. S. H. Hamilton suggested that the report should include the type of conducting glass used for operators windows on New York Central m. u. cars. Mr. Williamson said this had been touched upon in the 1950 report, and that if desirable, further information would be included in next year's report.

Communication Systems on Rolling Stock

The report of the Committee on Application of Radio and Communication Systems to Rolling Stock states that trouble has been experienced with the present communication train line jumper, especially on trains operating through low temperatures. During the past year, representatives of the committee held four meetings with manufacturers' representatives and prepared a revision of the jumper specifications.

This re-written requirement specification contemplates that a change in the insulation of the jumper cable pairs—possible to pure rubber—plus the use of an outer cover of material which would retain flexibility at a temperature of minus 40 deg. C., would provide the required flexibility at the expense of some increase in the effective capacity between cable pairs. Accordingly, the proposed specification increases the allowable capacity from 30 to 50 micro-micro farads per foot. Further revisions permit the use of a jumper cable consisting of five shielded pairs, two No. 12 and one No. 16 single-conductors non-shielded in lieu of seven shielded pairs as now required. Other additions and deletions were made to simplify the wording of the specifications.

Another work assignment to the committee was to recommend housing dimensions for radio transmitting and receiving apparatus for mounting in any location on the exterior of locomotives, water tenders, cabooses or cabin cars. The recommendation states that such housings shall be made of corrosion-resistant metal or steel which has been given a corrosion-resistant treatment inside and out. Dimensions recommended are, width—31.5 in., height—14.5 in., and depth—21.5 in., with a cover on the 31.5-in. by 14.5-in. side.

Concerning power supply the report reads as follows:

Since standard transmitting and receiving apparatus on rolling stock requires single-phase, 50-70 cycle, 105-129 volts r.m.s. power supply and since the primary source of power on rolling stock is predominately direct current, the problem of securing and maintaining a reliable and economical conversion unit has proven to be a major problem.

Early installations for alternating current radio equipment were made either with single phase power generated by internal combustion engine, steam and air turbine-driven alternators or direct current systems with motor generator sets provided to convert the battery voltage to the above mentioned a.c. voltage.

Comparative maintenance costs and reliability over the many operating conditions involved have resulted in the d.c. primary source of power with a.c. conversion equipment, being used almost universally.

Early in 1947, a vibrator (inverter unit) was developed which provided regulated sine-wave output. Later, refinements were made to this unit wherein, plug in, dual vibrator circuits were employed and a very satisfactory vibrator type converter is now available. While it is apparent that maintenance costs vary slightly from one railroad to another, general indications are that approximately 50 per cent savings can be made on both in initial cost and maintenance, using this type of inverter in place of others.

Normal life of the vibrator in service on switch engines has been between 60 and 90 days on a 24-hr., 7-day per week basis, while vibrator service life in diesel road locomotives is from 90 to 120 days, caboose service being over 6 months, life in each case being dependent on actual length of time vibrators are in service.

The big advantage in this inverter is that service is never completely lost if maintenance personnel replaces the defective vibrator after the automatic switch-over has been made, the interruption to the radio service is a matter of approximately one to two minutes for each vibrator failure.

It is not the committee's intent that this report be final on this assignment, but after discussion in the annual meeting and another year of development has been made, that a conclusive report can be submitted.

The report was presented by a committee of which W. S. Heath, electrical assistant, Atchison, Topeka & Santa Fe, is chairman.

Discussion

W. S. H. Hamilton (N.Y.C.) said that the committee's recommendations on power supply apparently contemplate conversion of all power to a.c. before it goes to the radio. The use of 12- and 14-volt d.c. power, he said, should be given full consideration for caboose power since, when it is used, filaments are fed from low-voltage d.c. power and only about half of the power needs to be converted to a.c. Committee Chairman W. S. Heath (A. T. & S. F.) replied that railroad men are evidently becoming cognizant of the advantages of 12-volt d.c. power. Mr. Hamilton then said his railroad has such equipment under development, and that he will report on it next year.

Electrical Repair Shops

The report of the Joint Committee on Electrical Facilities and Practices for Repair Shops was presented by C. F. Steinbrink, electrical foreman, Chicago, Rock Island & Pacific.

Previous committee reports gave information on apparatus required in motor shops and a sub-committee is now developing information on how this apparatus is used with view of making definite recommendations on such use. The present practices of the larger electrical manufacturing and repair companies and of railroads which are extensively engaged in this type of work are being developed for review and comparison.

The following specific questions are being investigated:

1. What methods and practices are followed for mechanical repairs of end bells, motor support bearings, motor support bearing housings, armature bearings, shafts, etc.?

2. What methods and practices are followed for electrical repairs to traction motors and main generators in connection with windings and commutators?

L. C. Bowes

Electrical Section—Mechanical Division Association of American Railroads

Officers

L. C. Bowes, *Chairman*, electrical engineer, Chicago, Rock Island & Pacific, Chicago

H. C. Paige, *First Vice Chairman*, assistant mechanical engineer, New York, New Haven & Hartford, New Haven, Conn.

R. I. Fort, *Second Vice Chairman*, assistant research engineer, Illinois Central, Chicago

Fred Peronto, *Secretary*, Electrical Section, Mechanical Division, A. A. R., Chicago

H. C. Paige

Fred Peronto

R. I. Fort

In view of the large field covered by the above subjects, in connection with the various types of motors and generators involved, the study is not yet completed and is continuing.

The routine testing of traction motors having been covered in previous reports, this investigation is being largely confined to practices on testing stacked armature laminations. The practices of the same companies mentioned under assignment 3 are being developed, information obtained so far indicating a wide variation in practice from no testing to rather complete testing.

The following specific questions are being investigated:

1. What tests are made with what test apparatus on traction motors and generators?
2. What means, if any, is used to check the quality and insulation of the laminations on armatures?

Replies are being received but are not yet complete, and study is being continued.

The report is signed by a Joint Committee of which J. W. Horine, general superintendent motive power—diesel, Pennsylvania, is chairman.

Discussion

Mr. Steinbrink (C., R. I. & P.) said he had asked questions of a number of roads, but that replies had been received too late for inclusion in the report. He recommended that more active men be added to the membership of the committee. L. C. Bowes (C., R. I. & P.) asked for more members for the committee, and suggested that questions to railroads be sent out earlier.

Wiring Diagrams for Rolling Stock

The report of the Committee on Wiring Diagrams for Rolling Stock consists of revisions of much of the data previously recommended and published in the Electrical Section Manual. It includes an illustrative diagram, sample, schematic, connection and construction diagrams, many diagrams showing schematic wiring symbols, recommendations for lead and terminal markings with illustrative diagrams and tables of identification letters for wiring diagrams.

The report is signed by a committee of which E. J. Feasey, general supervisor diesel equipment, Canadian National, is chairman.

Discussion

In presenting the report, Chairman Feasey said the committee

had found it necessary to completely revise material in the manual, and to include some omissions. S. B. Pennell (N.Y.C.) suggested that this would be a good time, if there were any disagreements between manufacturers and railroads, to have proposed changes submitted to both. W. S. H. Hamilton (N.Y.C.) asked if most manufacturers had not agreed to adopt specifications if they were adopted by the Association of American Railroads. R. I. Fort (I. C.) said that the members of the A. A. R. can do much toward setting up a set of standards and added that when such standards had been proposed to the manufacturers, they had been most cooperative. Mr. Hamilton said he thought the Electrical Sections should go on record in extending a special vote of thanks for the work which has been done by this committee.

Fig. 1—Main drafting room, engineering department, general offices, Baltimore & Ohio, Baltimore, Md., before the bowl-type lighting fixtures, with incandescent lamps, were replaced

Illumination

Since the report of the Committee on Illumination was compiled Chairman E. R. Ale has retired from railroad service, and the report was presented by L. S. Billau, electrical engineer, Baltimore & Ohio. The first section of the report consists of a comparative cost analysis of lighting systems employing respectively 85-watt fluorescent lamps in 4-lamp reflectors, 400-watt, high intensity mercury vapor lamps, and 1,000-watt incandescent lamps. All have a 25-ft. mounting height. All costs including installation, energy costs, lamp replacements, cleaning, etc., are included. For equal illumination, with power at one cent per kw.-hr., the analysis shows that the total annual costs of the mercury vapor lighting is 3 per cent more than fluorescent, and incandescent lighting cost is 18 per cent more than fluorescent, when lights are burned 2,500 hours per year. With higher power costs, the difference between the fluorescent and mercury lighting remains the same but the relative cost of the incandescent system increases. Longer burning hours are a further disadvantage to the incandescent system.

Fig. 2—The engineering department drafting room after the installation of continuous rows of semi-indirect fluorescent lighting fixtures

The latter part of the report consists of examples of good lighting in a drafting room and a railroad passenger terminal. It is reproduced here in full.

Drafting Room

The illumination of drafting rooms has always presented a difficult lighting problem as the requirements call for very high intensities of illumination without glare and with practically no shadows on the drafting tables. Totally indirect as well as semi-indirect lighting systems, using filament lamps, have been largely standard for this class of work, but as fluorescent lighting came into general use it was soon found that the illumination produced by direct lighting units was unsatisfactory and that units either of the diffusing type or semi-indirect type were necessary.

After studying different types of drafting room lighting systems, the Baltimore and Ohio has just completed the installation of a modern fluorescent lighting installation in the engineering department's main drafting room in its general office building in Baltimore. The size of this room is 136 ft. by 22 ft. The original lighting installation consisted of totally indirect lighting fixtures of the bowl type using incandescent lamps, which has been replaced with continuous rows of semi-indirect fluorescent lighting fixtures. The results obtained have been very satisfactory, uniform intensity of illumination being produced without objectionable glare and the elimination of shadows on the drafting tables. The following

Fig. 3 — General view of the main waiting room, Reading Terminal passenger station, Philadelphia, Pa.

furnishes some of the detail information covering the old and new lighting systems:

	Original Lighting	Improved Lighting
Room dimensions	22 ft. wide by 136 ft. long	22 ft. wide by 136 ft. long
Ceiling height	11 ft. 8 in.	11 ft. 7 in.
Fixture mounting	Chain suspended — 30 in. from ceiling	Stem suspension—23 in. from ceiling
Ceiling finish	Plaster, painted white	Acoustic tile—white
Type of lighting fixture	Incandescent, indirect	Fluorescent, semi-indirect
Number of fixtures	32	108
Type of lamp	300—500 watt I.F.	F 85 T-17/W
Number of lamps	16—300 watt, 16—500 watt	216
Fixture spacing	9 ft. 3 in. by 8 ft. 6 in.	Continuous rows, 5 ft. 3 in. C/L
Watts per sq. ft.	4.35	7.3 including losses
Average illumination	15 foot-candles	85 foot-candles, maintained

Figure 1 shows the original type of lighting system and Fig. 2 the new fluorescent lighting system. Conditions were such that it was necessary to take both photographs during daylight hours, with the consequence that the full effect of the artificial illumination is not shown.

Passenger Station

There has been considerable activity on the part of the railroads in modernizing many of the older larger terminal passenger stations throughout the country. A recent outstanding example is the Reading Company's terminal passenger station at Philadelphia. This terminal has recently undergone extensive alterations, including complete modernization of the waiting room, ticket office and train concourse, as well as the alteration of other station facilities. Fluorescent lighting was adopted for a large part of the terminal building. The lighting is of particular interest in that the design, type and arrangement of the lighting system were carefully worked out to fit in with the general architectural treatment of the building interior, resulting in not only providing much higher intensities of illumination but also very pleasing effects.

Briefly the lighting equipment and its arrangement consist of the following:

Three-tube, 40-watt fluorescent recessed troffer-type fixtures with

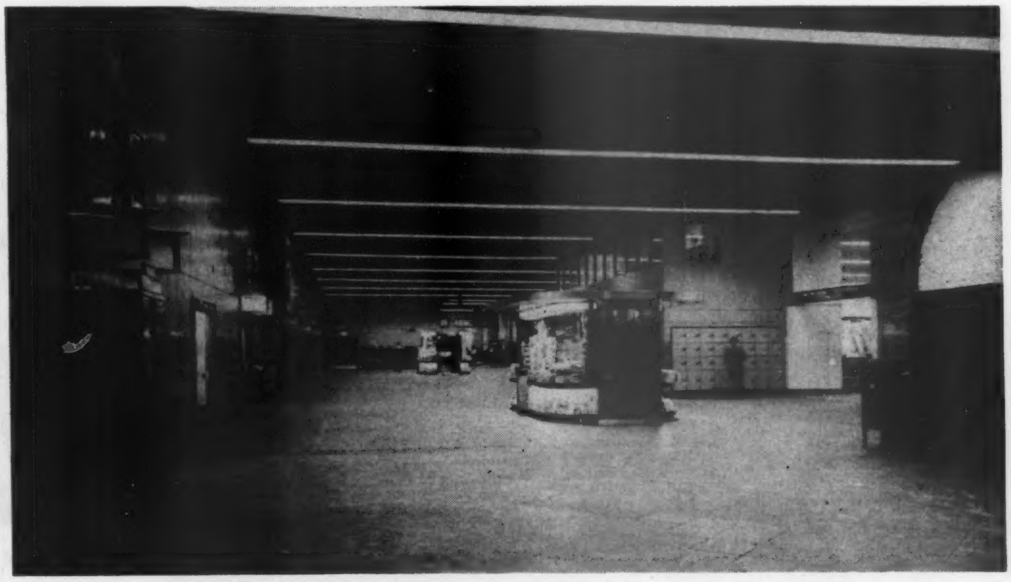


Fig. 4 — General view of the concourse, Reading Terminal passenger station, Philadelphia, Pa.

Fig. 5 — The new ticket office, Reading Terminal passenger station, Philadelphia, Pa.

controllers. Wiring is arranged so that the center tube is controlled on one circuit and the two outside tubes on another circuit. This permits a variation in the amount of light in the room since one, two or three tubes in each row of fixtures may be lighted at any time. There are six rows, each consisting of nineteen 48 in. fixtures on 20 ft. spacing, mounted 16½ ft. above the floor. The average maintained illumination is approximately 20 foot-candles. Figure 3 is a general view of the main waiting room.

Concourse

Three-tube, 40-watt recessed troffer fluorescent-type fixtures with controlens. Fixtures are hung from the ceiling by means of supporting rods approximately 6 ft. long. The ceiling above the fixtures is painted black for contrasting effect, and fixtures are at same height and in line with those in the waiting room to give the effect of continuous rows. Average maintained illumination in this area is approximately 15 foot-candles. Figure 4 is a general view of the concourse.

Ticket Office

All lighting is fluorescent type. In addition to the general overhead lighting in the waiting room, which also illuminates the ticket office, there are additional fluorescent lights over the ticket counter. This lighting consists of two rows of single-tube fluorescent strip lighting with 15-watt and 20-watt tubes mounted in the ticket counter light trough. Figure 5 shows the new ticket office and the effect of the lighting arrangement used.

Lighting in the men's room consists of 8-ft. and 6-ft. slimline fixtures on 18-in. suspensions, and with two exposed tubes per fixture mounted so as to form a continuous row around the sides of the room.

In the women's room, three-tube fixtures, similar to those used in the waiting room, are mounted in the accoustical ceiling.

Pendant-type industrial fluorescent lighting units, single or continuous, as required, and having two 40-watt tubes per unit, are installed in the parcel check rooms.

Under the marquees and in the lobby, there are two-tube, 40-watt recessed troffer-type with flat glass covers. Lamps are instant-start type.

Over moving stairways, there are two-tube, 40-watt, 30-watt and 20-watt fluorescent-type units.

The report was presented by a committee of which L. S. Billau, electrical engineer, Baltimore & Ohio, is chairman, succeeding E. R. Ale, retired.

During a brief discussion which followed the report, L. C. Bowes (C., R. I. & P.) called attention to a recently developed high-intensity, mercury vapor lamp with a red phosphor coating which removes the need for mixing incandescent lighting with mercury to obtain a good color of light.

Welding and Cutting

The report of the Joint Committee on Welding and Cutting deals entirely with welding on diesel locomotives. This was done because the diesel presents new problems to the welder.

Aluminum Pistons

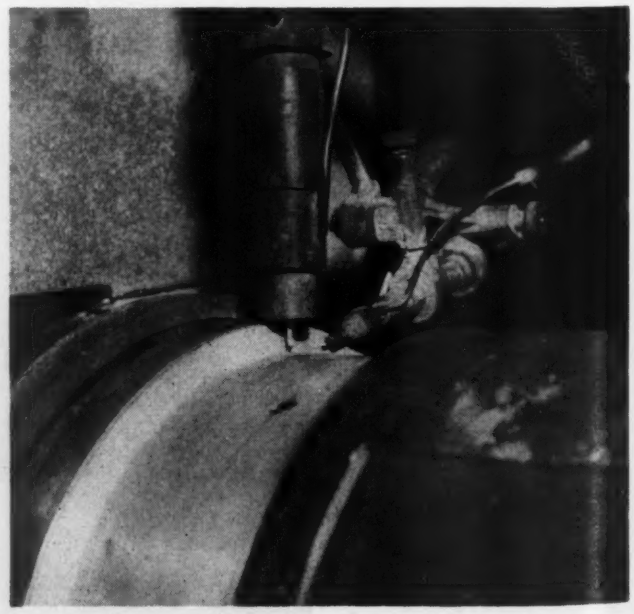
The report states that the inert, shielded arc is preferable for welding aluminum pistons. It describes the process and its application to the welding of pistons and offers the following conclusions:

It should not be taken for granted that the consumable electrode process is always superior to the tungsten arc method. In those shops where only a small number of pistons are to be reclaimed, the elaborate and most costly equipment for inert-gas shielded consumable electrode welding will not be justified as long as one man can keep up with the work with the tungsten arc process.

The inert-gas shielded consumable electrode process has proved itself highly satisfactory for diesel piston reclamation on the following points:

(a) It offers excellent economy.

(b) It yields deposits of entirely satisfactory quality.



Main and auxiliary feed wire for welding aluminum piston

(c) Operation is neither difficult nor critical.
(d) It is flexible.
Equipment required and procedures are illustrated.

Reclaiming Cylinder Heads

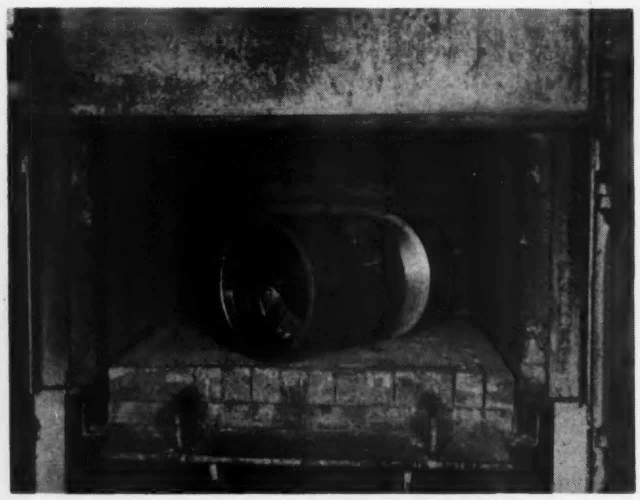
Cast iron cylinder heads, the report states, may be repaired at a fraction of the purchase price and have been found to be equal in every respect to new ones, when proper welding procedures and control are used and parts are machined accurately to original tolerance. The report further states that because of its versatility, oxy-acetylene welding is widely used for this work. Inert arc gas welding is also recommended in the report as being more economical because it does not involve the removal of slag. Procedures for welding heads are described and illustrated in the report.

Means for reclamation of engine valves, the welding of engine A frames, including liner seats, are also described and illustrated.

The report is signed by a committee of which L. E. Grant, Engineer of tests, Chicago, Milwaukee, St. Paul & Pacific, is chairman.

Discussion

In presenting the report, Chairman L. E. Grant explained that care in following procedure accurately was highly important since parts can be damaged by improper welding, by movement of parts during welding, etc.

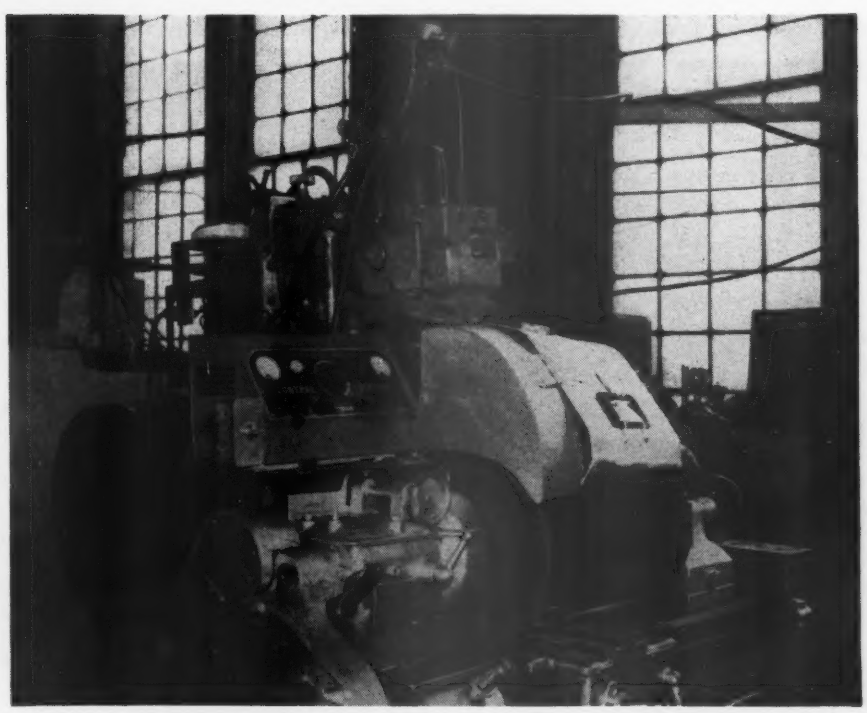


Above: Preheating diesel piston for welding

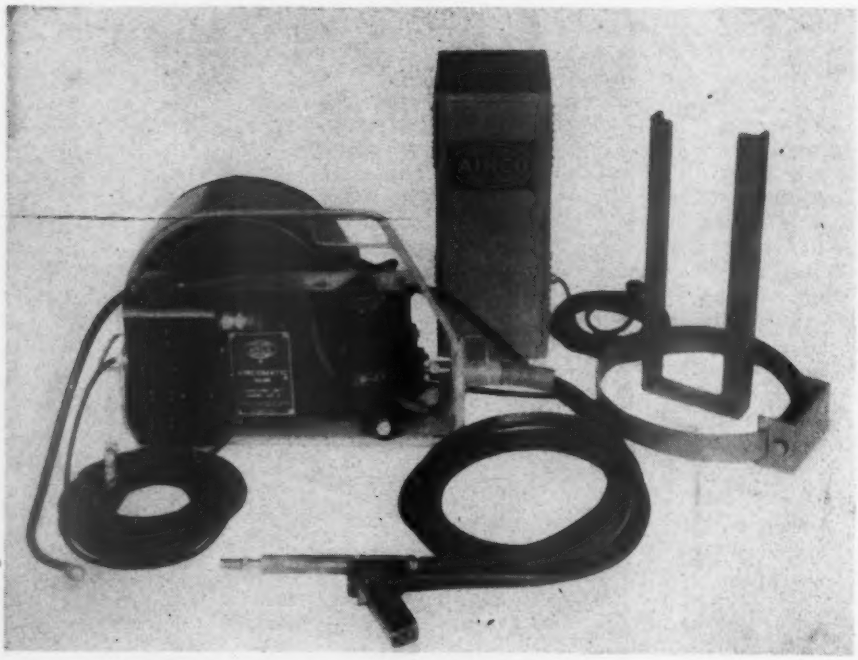
Aluminum diesel piston prepared for welding

H. C. Paige (N. Y., N. H. & H.) asked for the cost of reclaiming pistons by welding, wanting to know if it were, for example, one-half or one-third the cost of a new piston. Mr. Grant replied that it runs from one-half to one-sixth, the lower figure being obtained by the use of an automatic welding head.

Concerning the welding of cast iron piston heads, Mr. Paige said that its success requires very slow cooling—New Haven practice being to put the piston heads in a box full of asbestos and allow them to cool for two days.



Right: Automatic machine for inert-arc welding



Manual gun for inert-arc welding

Car Electrical Equipment

In response to its first assignment, namely, to continue the study of diesel engine-driven generator sets for individual passenger car power supply, the Committee on Car Electrical Equipment reports that about 125 such units are now in service and that there are 130 on order. No serious trouble has been experienced in their operation and the use of d.c. systems has been extended with highly satisfactory results. Concerning one specific installation, the committee reports as follows:

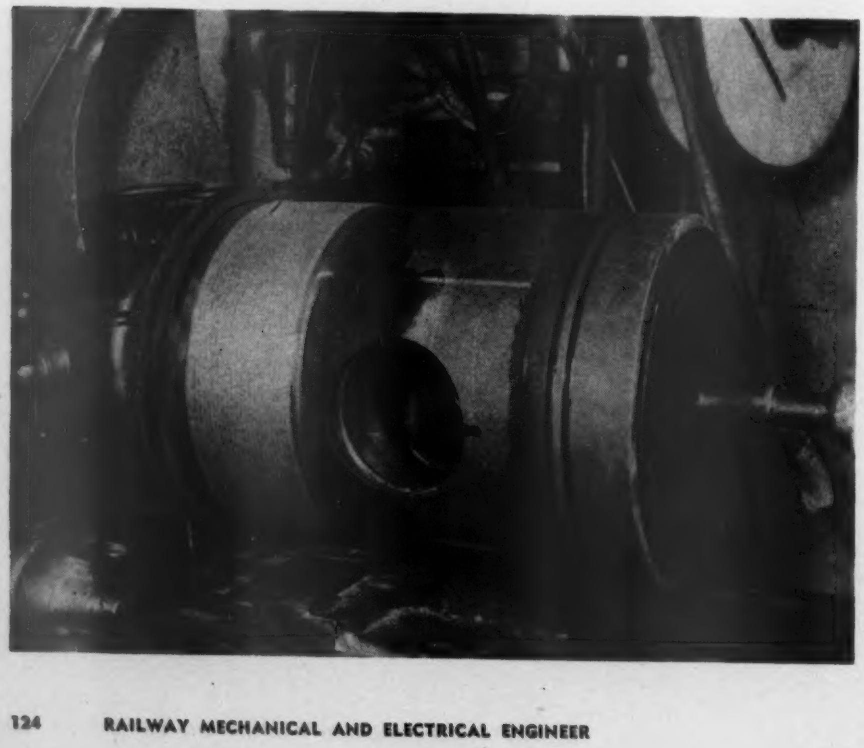
1. Increased capacity. The original units had a total capacity of 45 kw. with a total connected load of 60 kw. The new units will have a combined capacity of 60 kw. which is more in line with the total connected load.

2. Paralleling the two power plants. Parallel operation will reduce the complexity of control and switching circuits and provide greater availability of all appliances in case of partial outage.

3. Piping engine exhaust through the roof. The old method was to allow engines to exhaust under the car. At times, with a slightly smoky exhaust, adverse comments were made while the car was standing in the train shed before departure.

The results obtained from the above changes will be available for future committee report.

A major part of the report is concerned with proposed revisions of the Electrical Section Manual. The items covered include general specifications, generators, car-body terminal blocks, axle pulleys and bushings, generator regulators, reverse current relays, load-voltage regulators, inspection, shipment guarantee, etc., the a.c. end of motor-generators, axle-generator mountings and suspensions, clearances, steam and water drips, pulley axles and wiring. Concerning communication circuit jumpers, it is recommended that a completed jumper between cars should be 60 in. long overall. From information obtained by a questionnaire, it was learned that a majority of member roads recommend the use of six-point receptacles with a latch automatically released with a heavy pull.



Aluminum piston welded in a jig on automatic welding head

A preliminary study of trainlining of cars including capacity of switches, circuit breakers, coupler sockets, jumpers, etc., for 30-60- and 110-volt d.c. and 220-volt a.c., three-phase circuits, disclosed a rather sharp difference of opinion as to the trainline requirements and maximum loads that are to be carried on a standard trainline. Accordingly, the committee has prepared a questionnaire which will be used to correlate information on this subject.

Included in the report are four drawings showing four ways, used by different roads to protect overhead jumpers between cars with special reference to the protection of passengers heads. The committee recommends that this subject be referred to the Committee on Passenger Car Specifications, Mechanical Division, A.A.R., for consideration in the design of future passenger equipment.

The Electrical Section was requested by the A.A.R. Committee on Prices for Labor and Materials to develop a formula for how to charge a car owner for charging batteries of cars equipped with a.c.-d.c. conversion equipment when such cars are in Interchange or line service. The power used for this purpose is 220-volt, 3-phase, a.c. power.

In response to this request the Committee on Car Electrical Equipment has made the following recommendation:

It would appear that the following basic formula would apply and could be used in preparing bills for this service:

$$\text{Kw.-Hr.} = \frac{\text{Line Ampere x phase voltage x 1.73 x P.F. x hours}}{1000}$$

In practice, however, a number of difficulties arise. The 220-volt, three-phase stand-by facilities are generally not arranged for centralized metering of energy to individual cars. The average value of current to be used is not readily obtainable and it varies with the capacity of the battery, the initial state of charge, the time of charge and the condition of the battery. The average power factor is not readily determined. There is a tendency to leave the battery on charge longer than necessary when turn-around time will permit. These factors make an equitable application of this formula to individual cars difficult, if not impossible.

In view of this situation the committee decided to attempt to set up a cost on the basis of a flat rate per car.

The committee had available statistical data on 1981 cars charged for one railroad during a 13-month period at a large eastern terminal. This data showed that a number of batteries were placed on charge unnecessarily and many were left on charge longer than necessary. It, also, showed the state of charge of the batteries on arrival at the terminal. The committee also had available test data from which the average efficiency of the a.c.-d.c. conversion apparatus could be determined. This test data has been analyzed with the following results:

Weighted average specific gravity on arrival	1.172
Weighted average time on charge	7 hrs. 39 mins.
Weighted average per cent of full charge	56.7
Average efficiency of motor generator	56.7

During the average time available the average battery will be brought approximately to full charge. It is assumed 40 per cent of capacity will be added.

The cost of energy is based on a figure of 11 cents per kw.-hr., same as used by the Price Committee for d.c. energy. This cost was developed from tests made in 1935 and rechecked in 1947.

By using the statistics on the 1981 batteries and the test results, an average value for kw.-hr. furnished and corresponding costs can be derived as follows:

Most of the batteries concerned were 600-amp.-hr. capacity 64-volt. The energy capacity of the battery is, therefore, 64 x 600/-1000=38.4 kw.-hr.

40 per cent of this capacity is 15.36 kw.-hr.
Assume battery efficiency of 75 per cent
D.c. energy to battery is 15.36/.75=20.48 kw.-hr.
Average efficiency of m.g. set is 56.7 per cent
A.c. energy to m.g. set is 20.48/.567=36.1 kw.-hr.
Add service factor of 15 per cent = 5.4 kw.-hr.

Total kw.-hr.=41.5 kw.-hr.
Cost at 11 cents per kw.-hr.—$4.56.

Many batteries of smaller capacity as well as larger capacity are in use. The larger batteries would take more energy during the charging period. However, the only difference in cost would be for the alternating current energy, as maintenance, labor and fixed costs would be the same. Inasmuch as the rate of 11 cents per kw.-hr. is somewhat arbitrary and probably high for alternating current energy, it is recommended that no distinction be made between the various sizes of batteries.

As this assignment required immediate attention, the cost as determined by the subcommittee was reviewed and unanimously approved by all members of the committee.

Pending completion of additional tests and further detailed study still in progress, the following recommendation was submitted to the Committee on Prices for Labor and Materials:

"Electric current for charging storage batteries on cars equipped with a.c. motor driven conversion apparatus from 220-volt, three-phase, 60-cycle, facilities, including labor, per car charged—$4.60.

"Note: This charge applies irrespective of length of time car is on charge or number of cars on same a.c. charging line and does not include cost of precooling. Billing repair cards need only show 220-volt alternating current charging of batteries."

This recommendation was unanimously approved by the Price Committee on March 22, 1951.

The report is signed by a Committee of which S. B. Pennell, assistant engineer, New York Central, is chairman.

Discussion

Chairman Pennell, in presenting the report, said the committee had received reports of a considerable number of armature shaft failures, but had not had time to investigate these conditions. The present specification M 104 B calls for a steel having a maximum tensile strength of 90,000 lb. with a yield point of 60,000 lb. Consideration is being given to using M 127 steel, having a maximum tensile strength of 105,000 lb. and a yield point of 80,000 lb.

G. W. Wall (D. L. & W.) said he had been asked about the omission in the report of the designation "lamp regulator." He said that in the specification it had been termed "load regulator," since it really performs more functions than regulating lamp voltage.

Mr. Pennell said that there had always been much disagreement on what train lines should consist of and urged the members to give the subject careful thought when they receive the committee's questionnaire. He also said he thought that car builders should give special attention to jumpers between cars to permit interchangeability. L. F. Reynolds (The Budd Company) replied that the manufacturers are now working to reach an agreement on this subject.

Asked if the cost of 11 cents per kw.-hr. for battery charging power were not high, K. H. Gordon (Pennsylvania) said that while it is apparently high, it is really not the cost of power alone, but that labor and facilities represent a major part of the cost. Relatively, he said, the actual cost of power is "peanuts."

Car Air Conditioning

Concerning the air conditioning of dining car kitchens, the report of the Committee on Car Air Conditioning equipment has the following to offer:

Ventilation of dining car kitchens has always been a problem that is difficult to handle. One railroad has attacked the problem by using the following design criteria:

1. All kitchen windows and doors to remain closed.
2. Air flow between the diner section and the kitchen to be toward the kitchen to prevent odors entering the diner.
3. Air movement should exist in all areas of the kitchen.
4. Air velocity should be low enough to avoid drafts on the crew.
5. Air velocities should be high enough to permit the crew to feel air movement.
6. Air temperature throughout the kitchen, from floor to head level, should be as nearly equal as possible.

7. Sufficient air changes should be provided to insure maximum transfer of heat to the intake air.
8. Radiant heat protection should be provided for the crew.
9. Increased cleanliness in kitchen and diner by filtering of the air.
10. Provide air velocity across the range to pull heat, smoke, and cooking fumes away from the crew.
11. Elimination of grease from exhaust ducts to eliminate fire hazard.

Two distinctive types of temperature problems exist in the kitchen: radiant heat and convective heat. The first is handled by mechanical means, such as radiant shields, and the second by the transfer of heat to the inlet air.

Radiant Heat

Radiant heat protection was obtained by placing a shiny metal surface between the source of heat and the area to be protected. This reflective surface directs the radiant energy back towards its source. In modern stainless steel kitchens, radiant heat can become particularly severe, since once it enters the open area, it will reflect back and forth between the stainless steel surfaces and build up high temperatures. In the application on the road referred to, radiation shields consisting of stainless steel sheets with asbestos liners were installed over all doors on the front of the range, in front of the dishwasher, and around the vent stacks for the fire boxes.

Convective Heat

Pressurization of the car must be accomplished with fresh air from the diner system only, to prevent kitchen odors in the dining room. Therefore, the fresh air taken into the kitchen and exhausted from the kitchen was balanced so that the volume of inlet air is equal to the exhaust fan volume plus the air leakage through floor drains, broiler vent, fire box vent, and other exit points. This balance is important to maintain the proper flow direction, and to avoid excessive amounts of fresh air from the diner system for the purpose of pressurization. Temperatures that were obtained at various locations in the kitchen were dependent somewhat on outside temperatures.

The difference between ventilating and cooling should be recognized in evaluating any system. Good ventilation is accomplished by introducing a sufficient number of air changes per minute and distribution of air to all areas of the kitchen. Such a system will provide maximum results obtainable by ventilation.

In this system, a fan draws fresh air through a hooded inlet on the side of the car; it passes through filters and finned radiator heating coil, and is thermostatically controlled for tempering the outside air during the heating season. Below the hood, covering the fresh air inlet, an air scoop, having a width of 3⅜ in., is installed to assure air being delivered in the kitchen at all train speeds. The scoop is placed 2¾ in. below the center of the hood, and it is angled down from the center of the scoop at a 5 deg. angle in both directions, so as to scoop air into the hood regardless of whether the kitchen end of the car is run forward or to the rear of the train. There is an inlet grille in the hallway opposite the kitchen, which feeds cooled air from the dining room into the duct, where it is mixed with the outside air before it enters the kitchen. A rectangular duct, measuring about 14½ in. by 15½ in., extends along the center of the kitchen about 3 in. from the ceiling for a distance of about 9 ft. The end of this duct is sloped back at the bottom 20 in., so as to provide a larger area of distribution. About 33 in. from the end of the kitchen where the duct enters, was located a 30 in x 8 in. air diffusion grille in the bottom of the duct. The grilles of the main air discharge duct are of a type which permit the air diffusion point to be adjusted to permit direction of the air flow as desired.

The exhaust system in the kitchen was designed to draw air across the top of the range, thus taking the heat directly off the hot surfaces and away from the crew. Since only one exhaust fan is used, all the fresh air to the kitchen passes over the crew before contacting the highest heat sources, and then is ducted to the outside of the car. The exhaust system over the range consists of two inter-connected ducts leading to a 2000 cu. ft. per min. exhaust fan in the ceiling. The exhaust volume is controlled by dampers in the exhaust ducts. A modified mushroom type hood is installed over the exhaust fan outlet on the roof; louvered outlets are provided on each side of this hood, the forward and aft position of the hood being closed off. Two grease filters are installed at the entrance of the exhaust duct above the range, and two drip pans are provided beneath these filters. A single speed switch controls both the intake and exhaust fans and it is located adjacent to the entrance door of the kitchen.

A northeastern railroad built ten conventional floor plan diners having pantries and kitchens air-conditioned. A 3-ton refrigeration capacity split evaporator unit is located above ceiling at lobby section. This unit supplies 800 cu. ft. per min. of conditioned air, all fresh. 700 cu. ft. per min. of the supplied air is delivered to pantry and kitchen through duct and ceiling diffuser to these two sections. The balance of 100 cu. ft. per min. of air is delivered to kitchen end of passageway.

The air is exhausted from the kitchen by a 600 cu. ft. per min. air capacity centrifugal fan located over passageway at kitchen end of the car. For the pantry, a 200 cu. ft. per min. propeller type exhaust fan is provided.

There are no windows or other means of ventilation in kitchen or pantry than the air-conditioning system previously described.

The dining room of these cars is equipped with a five-ton refrigeration capacity evaporator unit, arranged in the conventional manner. Both the three-ton kitchen and five-ton dining room air-conditioning units are operated from separate compressor and condenser units beneath the car floor.

Air Conditioning of Suburban Cars

In air-conditioning the double deck multiple unit suburban cars on one railroad, the problem was approached on the basis that sufficient cooling should be provided to afford "comfort" conditions during the relatively short period the passengers are in the cars. On this basis, the retired tonnage was kept within reasonable limits, and an adequate precooling period was designated to lower the car temperature before the admission of passengers at the originating terminals. These cars, which have a seating capacity of 132 passengers, have been in use approximately four years and have given excellent service.

The air-conditioning system includes a 6½-ton direct expansion air-cooled Freon refrigerating compressor, belt driven from a 13 hp. compound wound, 1470 r.p.m., nominal 600-volt d.c. motor, and an extended surface air-cooled type condenser with a 1 hp. compound wound, 1750 r.p.m., nominal 600-volt d.c. condenser fan motor. The overhead air-conditioning unit consists of a 6½-ton extended surface type evaporator, a 2000 cu. ft. per min. duplex blower, belt driven from a 1 hp., compound wound, 1750 r.p.m. nominal 600-volt d.c. motor and two banks of 325-volt, 600-watt each strip heaters (total 14.4 kw.). The floor heat consists of 78 strip heaters, 325-volt, 600-watt, each located beneath the seats in the lower deck and in the side wall for the upper deck seats.

Approximately 450 cu. ft. per min. of fresh air is taken from the vestibule of the car through a suitable ceiling grille and viscous type filter, mixed with approximately 1550 cu. ft. per min. of filtered recirculated air, cooled and dehumidified in the overhead air-conditioning unit, and then distributed to all areas of the car through a center deck duct having a continuous perforated outlet plate.

A 12 in. propeller type ceiling exhaust fan, which provides for the removal of vitiated air, is arranged for operation on nominal 660 volts d.c. service.

All motors are designed for a voltage range of 400 volts to 700 volts d.c. and are capable of withstanding a hi-pot test to ground of 2500 volts (r.m.s.) a.c. for one minute.

The temperature control and compressor motor control circuits are arranged for nominal 32-volt d.c. (range 27 to 45 volts) service.

The master air-conditioning control panel has a single selector drum type switch with positions for heating, ventilating, off, and three positions of cooling—low, medium, and high. Mercury tube type thermostats are employed for temperature control. Bimetallic thermostats, located on the down stream side of the overhead heating elements, are employed to disconnect these heaters in the event of a fan failure and thus prevent overheating of the elements.

Twenty postwar 100-passenger 85-ft. suburban coaches were

purchased by one railroad in 1949, twelve of which are air-conditioned. The balance of eight are equipped with a pressure ventilation system.

The air-conditioned cars are equipped with a 220-volt three-phase 60-cycle 25 kw. diesel alternator power unit, supplying power for the air-conditioning system and car lighting. The evaporators are located above ceiling at center of the car, handling approximately 3000 cu. ft. per min. of air which is discharged equally to center ducts toward ends of car and distributed to car through perforated ceiling panels.

The fresh and recirculated air is admitted to a common plenum chamber through separate filters, and so proportioned to provide approximately 0.1 in. w.g. positive pressure in cars with doors closed. Exhaust air is handled by roof vents located at either end of the car. The operation of the cooling system is thermostatically controlled.

For heating, electric resistance heaters are located in air duct above air distribution panels. These electric heaters carry heating load down to outside temperature of 25 deg. F., below which heating capacity is supplemented by the conventional steam overhead radiator.

The pressure ventilation system, with which the balance of eight cars are equipped, consists of the installation of four vertical pressure propeller type fans, mounted flush with a dropped ceiling. The space between the dropped ceiling and inside lining of roof forms the plenum chamber for the air supply to fans. The fresh air is admitted through roof grilles to filters, and recirculated air is returned to plenum chamber through ceiling grilles and filters. Each fan is protected by duct baffles, so that the respective fans are each supplied by their own intakes for fresh and recirculated air.

For seasonal control of air volume and proportioning of fresh and recirculated air, the fresh and recirculated air grilles are equipped with dampers, manually operated, and also, the air volume of the fans is varied by thermostatic control. The damper settings are as follows:

1. Summer Operation—Fresh air intakes wide open, recirculated air grilles closed.
2. Spring and Fall—Both fresh air intakes and recirculated air grilles partly open.
3. Winter Operation—Fresh air intakes closed, recirculated air grilles open.

The 64-volt fan motors are thermostatically controlled to operate all four fans at full speed in parallel above 85 deg. F.; below 85 deg. F. and above 75 deg. F. the fans operate in series parallel; and below 75 deg. F. the four fans are in series.

Thirty double deck gallery type suburban coaches were purchased by one railroad in 1950. Twenty-five cars, without toilets, seat 148, and five cars, equipped with toilets, seat 145. The entrance to the car is through two automatic sliding doors at each side of car at center of car.

Each car is equipped with two propane-driven ice engines and two evaporators. Each evaporator has a capacity of 6½ tons. The two air-conditioning units are located above ceiling at center entrance vestibule. Each air-conditioning unit handles 2400 cu. ft. per min. of air. The fresh air is taken in through grilles in lower section of roof at both sides, above entrance doors. The air is discharged into the upper level from a central overhead duct. For the main floor space, the air is distributed from diffuser located beneath the gallery. Conventional steam heat fin tube floor heat radiation is provided on wall side, both ends. The cooling is thermostatically controlled by manual selective automatic thermostats with three settings, 71-73 deg. F., 74-76 deg. F., and 78-80 deg. F.

Electronic Filters

Concerning the use of electronic filters, the report states that while this type of filter provides an effective method of cleaning the air, it also presents problems of maintenance, the solution of which will be extremely difficult. The committee feels that this type of filter, in its present state of development, is both uneconomical and impractical on passenger cars.

Temperature and Humidity Control

The report states that the desirability of the completely automatic panel in sleeping cars is questionable, and it is the opinion of the committee that on cars which have an attendant in charge, at all times while occupied, a modified version of the automatic panel which will permit reasonable variations to suit individual demands is necessary.

It is the consensus of the committee that on non-sleeping cars a semi-automatic panel having three positions on the selector switch, including off and two temperature positions, is desirable. The particular temperature values of the associated thermostats should be designed by the individual railroad.

Heating of Passenger Cars

The report of subcommittee No. 4, assigned to a general study of heating of passenger cars consists of a brief history of the development of car heating. It makes interesting reading and should be of considerable value as background information to all who are responsible for the design, operation and maintenance of car heating equipment.

Subcommittee No. 6 on waste product heating did not report.

Mechanical Refrigeration

Assigned to investigate mechanical refrigeration for purposes other than air conditioning, subcommittee No. 6 produced a report divided into two parts. The first of these outlines a recommended procedure for the inspection and maintenance of electric water coolers. In this it recommends that water temperature be kept between 45 and 50 deg. F.

The second part of the report, which concerns the performance of a Carbofreezer dry-ice refrigerator, describes a test designed primarily to develop information on stratification and offers the following conclusions:

The tests indicate that there is no more objectionable stratification in this type of refrigerator than any other type; however, they do indicate that the already good performance of the Carbofreezer can be improved by the installation of a circulating fan. The use of a fan may be objectionable, due to the maintenance and wiring involved. Therefore, application of a baffle around the outside of refrigerant coil may assist in also alleviating the extreme temperature differential, but no tests were made along this line. In any event, the thermometer can be installed near the controlling thermostat, if thermostat is properly located to give a representative temperature of the entire box.

The location of the controlling thermostat on units that were tested was on the side wall, away from the ice compartment, was satisfactory and controlled very close to its setting. However, some boxes have been observed that had thermostats located near refrigerant coils under the unit, which was unsatisfactory due to frost building up on and around the thermostat, causing unstable operation.

As the consumption of dry ice will naturally depend on the size and type of box, and whether refrigerator doors are opened frequently, tests have developed that kitchen refrigerators will use approximately 2½ lb. of dry ice per hour, and bar refrigerators will use approximately 1 lb. of dry ice per hour, during normal operation.

One railroad that is an extensive user of dry ice refrigeration in dining and lounge cars feels that this type refrigeration is a sound improvement over wet ice boxes, due to being more economical in cost of ice and over mechanical refrigeration due to the low cost of maintenance.

As a matter of information, the latest Carbofreezer units are being equipped with a self-acting mechanical valve to control the circulation of the refrigerant, in lieu of the electrical thermostat and associated solenoid valve, thereby eliminating the necessity of conduit and wiring into the box.

The final section of the report consists of recommendations for revision of the Electrical Section Manual and deals with maintenance procedures for motor-operated steam valves, pressure-reducing valves, refrigerator units and direct-mechanical air conditioning equipment.

The report is signed by a committee of which K. T. Benninger, general electrical supervisor, Chicago and Eastern Illinois, is chairman.

Discussion

W. S. H. Hamilton (N. Y. C.) asked if the three positions of the selector switch referred to in the report were OFF, HEATING

and COOLING. Chairman Benninger replied that they are either OFF, DAY and NIGHT, or OFF, HIGH and LOW, with automatic control of heating and cooling.

R. I. Fort (I. C.) asked if there were at present any applications of waste product heating and Mr. Benninger replied that experiments were being made and that the committee would cover these in a later report.

The report recommends drinking water temperatures between 45 and 50 deg. F., and it was suggested that 50 to 55 deg. F. might be low enough. A general discussion indicated that most members preferred the lower range, while a number would like to have it still lower. One reason for this opinion is that when a passenger comes from an adjoining car, having ice-cooled water into one with mechanically-cooled water, in the 50-55 deg. F. range, he gets the impression that the system is not working. R. I. Fort (I. C.) said it was his understanding that the U. S. Public Health Bureau puts a floor on minimum drinking water temperatures, and suggested the committee find out what it is.

No report was made on the committee's assignment to explore developments of sealed refrigerating units, and W. S. H. Hamilton (N. Y. C.) said the committee should keep in mind the fact that inverters for producing 3-phase, a.c. power are now available in much larger sizes than heretofore. C. E. P. Smith (Frigidaire Division—General Motors) said his company now has a 7½-ton sealed unit which is water-cooled and may have an air-cooled unit. E. L. Morris, (E. A. Lundy Co.) said it is possible to produce sealed units in sizes above 4 tons if the railroads want them. W. J. Madden (Pennsylvania) added that the Westinghouse Electric Corporation has produced a sealed reciprocating unit of 5 tons capacity and that there are sealed water-cooled commercial units for stationary service of 25 and 30 tons capacity.

W. S. H. Hamilton (N. Y. C.) asked how many roads phase their standby power to run motors in one direction only, when connection is made with either side of the car and how many have phasing opposite on opposite sides of the car to permit checking operation of equipment in both directions. With the latter arrangement, it is possible to cause a short circuit by plugging in power on both sides of a car. Most members expressed preference for the two-way rotation, and apparently feel that ordinary safety precautions can prevent trouble from this cause. It was also pointed out that unless proper precautions are taken, phase rotation may be reversed when plugs and portable cables are repaired.

Concerning by-product heating, K. H. Gordon (Pennsylvania) said his railroad will have eleven diners with undercar power plants on which by-product heating will be used, both for heating of water and space heating, by employing both jacket and exhaust heat.

L. C. Bowes (C., R. I. & P.) said apparently no railroad ever has any trouble with air conditioning equipment. In response, J. A. Andreucetti (Secretary Emeritus) described some failures in his experience, and spoke of fumes developed by engine-operated equipment in terminals.

A. L. Kelly (M. P.) said that trouble is practically certain if it is necessary for an axle-powered car to stand for 2 or 3 hours. A. E. Voigt (A. T. & S. F.) said the best possible means of avoiding trouble is to get the maintenance man to understand the importance of his job. He added that when it is realized that air conditioning maintenance is of equal importance to locomotive maintenance, better results will follow.

R. F. Dougherty (U. P.) said that tests he had made showed that a 1,000-amp.-hr. battery on a car would operate all car equipment for 2½ hours before the low voltage took the load off the line. He added that in actual service cars had operated longer than this, since, the tests were more severe than conditions normally found in practice. He said batteries are a pretty reliable source of power. A. E. Voigt (A. T. & S. F.) concurred that the battery is a reliable source of power, but said that its capacity must be understood. He told of a case in which five trains were marooned in the recent flood at Emporia. Power was supplied with utility company power, and engine-driven welding sets. He said that with engine-driven power, a supply of fuel is necessary and added that with batteries augmented with usually available outside power, almost all conditions can be met. Mr. Kelly agreed to the reliability of battery power, but said the service it can give is limited, adding that it must be supported by expensive standby power facilities. He said, also, that he considers engine power to be highly reliable.

H. W. Dillon (S. P.) described tests made on the Southern Pacific in which cars were operated for six hours on the battery. He also said that they have been operated on the road for seven hours without complaint from the passengers.

W. S. H. Hamilton (N. Y. C.) said the New York Central uses 32-cell, 600-amp.-hr. batteries on its air-conditioned cars and that the general results of tests made at 125 amp., which is top load, the batteries operated from 1¾ to a little more than 2 hours, after which the batteries would operate the blowers for 4 and 5 hours. He said the controls could be so arranged that modulated or reduced air conditioning would be used whenever operation was from the battery alone. He expressed the opinion that both axle- and engine-driven generators have a place and added that diesel engines fail as well as axle generators.

J. E. Gardner (C. B. & Q.) said that in reporting such tests, the outside temperature and state of charge of the battery should be included.

Chairman Bowes put the question, "Why do we have failures?" A. L. Kelly (M. P.) responded by saying, "It is a maintenance problem." A man in the yard, he said, is frequently busy and lets a car go to the next trip. Closer attention, he said, will help. J. E. Gardner (C. B. & Q.) said there is plenty of automatic control, and that he would like to get rid of a lot of gadgets. He said he thought everyone would agree that the majority of failures are caused by minor equipment. He added that one important source of difficulty is due to the high turnover of manpower.

G. R. Berger (George R. Berger Co.) called attention to the fact that a battery which has a capacity of 1,000 hours at the 8-hr. rate, will have about half that capacity when discharged in 3 or 4 hours, and not more than one-fourth rated capacity when discharged in 2 hours.

R. F. Dougherty (U. P.) took exception to the statement that control equipment causes most of the failures. These are, he said, usually caused by someone not doing his work properly and are not limited to control equipment.

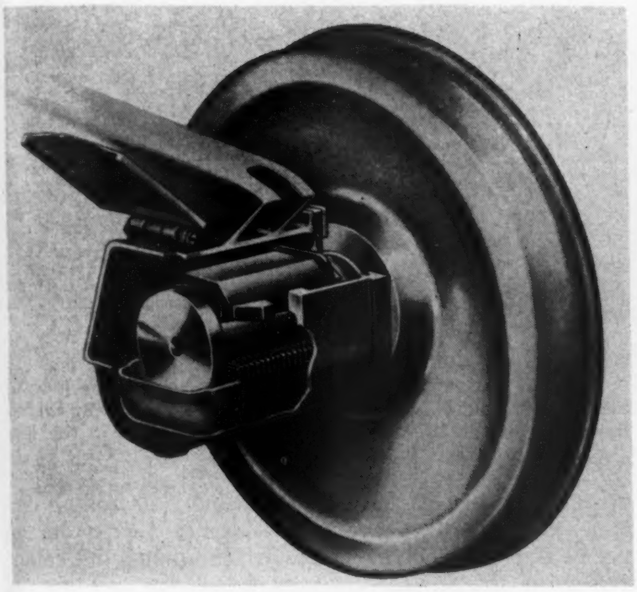
W. J. Madden (Pennsylvania) said that it was his experience that it was possible to obtain 4½ hours of air conditioning service from a battery with 6 to 7 hours service for blowers and lighting through the amplidyne inverter. He added that difficulties were frequently increased by improper operation of the equipment by the train crew.

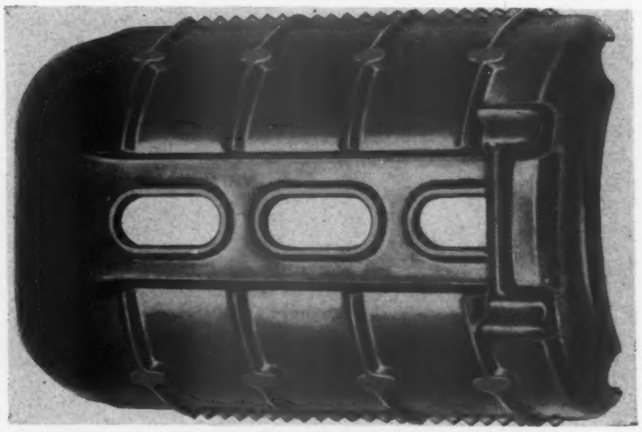
K. H. Gordon (Pennsylvania) produced figures to show that out of 36 air conditioning failures, 5 were of doubtful origin, 11 were due to crew failures, and 20 were bona fide equipment failures. In response to a statement that air conditioning failure occurred in third-rail electrified territory, Mr. Dougherty (U. P.) said that the head-end power they had had was like third rail power, and that they had control failures on these trains. He added that, however, most of the failures were due to insufficient maintenance. Roy Liston (A. T. & S. F.) said everyone agrees on causes of failures, but no one has offered means of correcting them. He suggested that conditions can be greatly improved by better training of maintainers and, having a form sheet kept in each car, showing what had been done by what man. Mr. Dougherty said he had used cards without too much success, because, although the maintainer had done the work assigned to him, the car might still go out with a ground, with a dead battery or with a generator not working. It is better, he said, to follow the man and see that the work is done than to find out why the car failed. H. J. Dawson (I. C.) expressed the opinion that most supervisors should be complimented on the work they are doing. He explained this by saying that while the Interstate Commerce Commission says certain things shall be done, generators, etc., do not insist upon it.

In support of his suggestion for using cards, Mr. Liston said one need not sit in the office and wait for cards to come in, but that they provide a valuable check. Mr. Dougherty replied that the oldest men in service are causing the most trouble, and the new men, properly trained, and interested in the job, are good for satisfactory maintenance. Chairman Benninger agreed with Mr. Dougherty and said that when railroads get to the point that they hold cars with failed equipment, they will begin to make progress.

The report of the Committee on Automotive and Electric Rolling Stock and the L.M.O.A. report on cleaning and testing of traction motors, main generators and other electrical equipment will be covered in the December, 1951 issue.

NEW DEVICES





▲ Bottom view of the package retainer showing the trough for added resiliency and the holes in the trough which permit waste to contact free oil in the bottom of the journal

◀ Cutaway view of a journal box showing the Hulson retainer in place

▼ By using a packing iron underneath the retainer to work it into place, it can be forced in with the free hand

Package Type Waste Retainer Tested on Two Roads

One of the newer developments for combating waste grabs, displacement of waste, hot boxes and other journal troubles is a package type waste retainer developed by the Hulson Company, Chicago, and included in the Association of American Railroads' list of packing retainer devices approved for roads desiring to use them as per Interchange Rule 101. This waste retainer and container is made of oil-resistant synthetic rubber with sufficient resilience to hold the waste against the full length of the journal at the proper pressure for adequate lubrication.

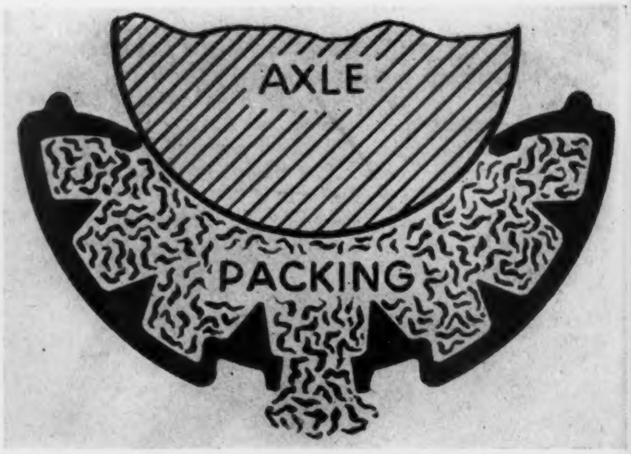
The container, trade-marked Flex-Pak, was originally designed early in 1947, and the first application was made in October, 1948, on the Chicago & North Western. Tests on this application showed a possibility for reducing inspection cost considerably and for attaining savings in journal-box packing and in the labor of application. Since the original design, several changes have been made to improve the performance of the retainer, and the present model was adopted in June, 1950.

Additional experience with Flex-Pak has been gained on the Pennsylvania. Twenty-five B60B head-end cars so equipped have gone through the second brass change with no hot boxes due to the Hulson container.

In stationary laboratory tests the Pak and box were chilled down to 50 deg. below zero, and there was no displacement of the Pak or the waste on the breakaway. At subzero temperatures the container loses pliability, becoming stiff and hard but not brittle. It tends to freeze to the box. The lips stiffen to help hold the waste in place.

Application of the Hulson retainer is simple. It can be applied to standard A.A.R. boxes without removal of the brass. It fits underneath the waste-retainer ribs in all sizes of standard boxes and in the same position in boxes without ribs. The Flex-Pak need be removed only at established repacking periods, at which time it should be thoroughly cleaned along with the box.

Some of the principal advantages claimed for the Hulson container in addition to its role in reducing hot boxes are: Only about half as much waste is required to



▲ Diagrammatic view of the operation of the Flex-Pak in keeping waste in place

◄ After all packing is removed and the bottom of the journal box cleaned, the Flex-Pak is wiped with oil, the combs folded downward at the fillet end, and container stuffed in the box

pack the journal box when the container is used, and the packing does not have to be set up after the car is humped. Impacts from all causes—low rail joints, rough coupling, surges in the train, etc.—are absorbed by the container which returns the waste to the proper position immediately. A trough along the bottom helps to improve the resiliency. Waste is prevented from rolling out under the collar by cone-shaped lugs in the bottom of the retainer. If packing is pushed out under the collar in service, this indicates too much packing.

Slots included in the bottom allow a certain amount of packing to be forced through the retainer when the waste is applied. This packing then acts as a wick to draw free oil from under the container. By adding free oil as required, both the journal brass and the combs of the container will be well lubricated, keeping wear of both to a minimum.

Reflector Type and Sealed Beam Lights

Recently available are two new type sealed beam Gyralites for general rear-of-train use, or for front of train use in slow speed service such as switcher locomotive and scale cars. One is combined with a sealed beam back-up light, the other without.

These Gyralites were developed to fill the need for more adequate train protection created by modern high-speed railroading combined with greater traffic density. The rear-end units provide an emergency warning beam of red light (or any other signal desired) to notify overtaking trains that a train ahead has slowed down or stopped.

Permanently mounted on observation or business cars or temporarily hung on rear-end cars (portable models) its high intensity moving beam travels in a circular pattern. The lowest point of the beam path is directed straight down the track. In the rest of its circular path, the

(Continued on page 134)

The Gyralite at the left is combined with a sealed-beam back-up light

(Continued from page 130)
beam is projected upward and outward creating a brilliant sky effect and sweeping both sides of the right of way.

The two models are furnished with a type Par-56, 200 watt locomotive sealed beam lamp mounted in a 'gyrating' mechanism within a cast aluminum alloy housing. The combination model has in addition, a second Par-56, 200 watt lamp mounted in a door as a stationary white back-up light. Two types of automatic controls are offered, the air pressure type and the generator voltage type.

The automatic air control types operate when the air brake pressure changes from the selected air switch pressure setting. They continue to operate after the air pressure is restored and until manually reset by pressing the reset push button.

The automatic train speed generator control types are controlled through the car generator reverse current contactor. They are automatically turned on when the contactor is in the 'on battery' position when train is stopped or traveling at low speed; they are automatically turned off when the train regains speed and the contactor is in the 'on generator' position.

Manually controlled types are operated by the master selector switch provided in the top of the light or by remote control switches for operation from any desired point in the car. These units are available from The Pyle National Co., Chicago.

Tool Suspension and Air Supply Hose Reel

The combined tool suspension and air supply hose reel introduced by The Wayne Pump Co., Fort Wayne 4, Ind., is a compact, completely packaged unit easily installed over the work bench on high-speed production assembly lines. A pneumatic screw driver or other tool is suspended on the hose which supplies the air, requiring no cable suspension with separate air hose. Weight of the tool is counterbalanced by the spring tension of the reel.

Releasing the tool lifts it automatically to a predetermined convenient position directly over the work spot. Automatic uptake of tool leaves both hands free to remove work from machine. No wrenches, triggers, locks or other devices are necessary to change spring tension. Merely removing a turn or two of hose decreases tension and wrapping hose around the spool increases tension.

Fifteen ft. of ¼ in. inside diameter hose with male-fitting standard is provided. A rubber bumper stop is utilized to control length of travel when tool is released. Universal mounting brackets permit mounting on post, wall, or hanging cable.

Remote Indicating Engine Warning System

For engine application it is desirable to protect the engine against high water temperature, high lube oil temperatures, low lube oil pressure, etc. Controls and warning devices for this purpose take many forms. Basically, these systems give signals only when abnormal conditions develop. If the light does not flash, or the buzzer sound, it is assumed that a normal operating condition exists.

Tellite, developed by the Rochester Mfg. Co., Rochester 10, N. Y., gives three indications—light off—dim light—and flashed light. A dim, visible light glows when all connected units are operating normally. It remains dim when the engine idles. A temperature rise, low oil or air pressure, or any such conditions which would make engine operation unsafe or detrimental, causes the system to flash the warning: bright—dim, bright—dim. Thus the operator is always warned before serious damage is done.

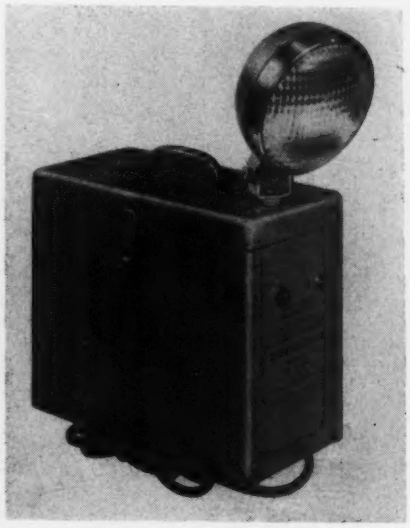
Tellite was developed to provide a flashing light signal to warn the operator of any engine malfunction which might result in damage to engine parts. Basically, it is a remote indicating, warning system, showing low oil pressure, low air brake pressure, excessive heat rise, generator failure or the partial set of the hand brake.

A strong point in its favor is a dim glowing light which always shows under normal conditions and indicates the system to be in working order. When this light is out, one of the conditions mentioned above has developed, and thus warns of its own failure.

Any number of pressure and temperature control switches may be used in this warning circuit without affecting the operation of this system. By this method, one warning light may be used for checking a large number of temperature and pressure points throughout an engine. The operator can easily determine the cause of the flashing light by checking his engine instruments. If preferred, however, one Tellite can be used for each separate part of the engine, as is the normal procedure on diesel locomotives, etc.

Many typical warning system applications require controls in conjunction with them. Typical of this are the warning and control systems installed on diesel locomotives. These are designed to warn of the source of trouble, using flashing lights and buzzers, and in addition reduce the speed, or stop the engine before a dangerous situation develops. The Tellite pressure and temperature switches are designed to serve this dual role simultaneously, or independently, if desired.

◆



Automatic Emergency Light

Insurance against light failures in large and small buildings is provided by the Exide Lightguard emergency lighting unit, made by the Electric Storage Battery Company, Philadelphia, Pa. Each unit is about the size of a portable typewriter and consists of one or two 25-watt sealed-beam floodlights with power supplied by a thick-plate glass jar storage battery. A magnetic switch automatically connects the floodlights to the battery when the normal current is interrupted. When the unit is not in use, its battery is kept fully charged from the regular electric circuit, since it is always plugged into an outlet. When normal power service is restored, a relay automatically turns off the flood-

lights, and turns on the charging unit.

The lamps are adjustable to provide light in any direction desired. A single lamp unit will furnish light continuously up to six hours and two-lamp units will operate up to $2\frac{1}{4}$ hours, when the light output will be approximately 70 per cent of peak. The lights can be turned off by a manually operated toggle switch. When the toggle switch is turned to the OFF position, a neon pilot light goes out, indicating that the unit is not set for automatic operation. Pulling the plug at any time provides a simple way to test the automatic action of the unit, since this is equivalent to a power failure.

Adhesive Backed Felt Tape

A reinforced felt tape with a pressure-sensitive adhesive back has been announced by the Products Research Co., Glendale 3, Calif. Known as Kling Felt, it does not require a paper or other separation material between layers and can be applied very rapidly.

Uses for the product include rattle and squeak deadening; sealing against dust, wind, fumes and foreign materials; as a thermal insulator; for vibration and shock cushioning in fragile crating and on machinery; for scratch protection and protective applications such as electric control panel doors; weather-sealing; casket sealing for inter-state shipment; anti-squeak and seal on truck cabs; anti-scratch base for desk equipment, and a cushion for instrument shipping.

The adhesive back eliminates need for gluing or tying. The pressure of a finger will make it stay put on overhead and vertical positions until it is forcibly removed.

This felt is available in rolls from $\frac{1}{4}$ in. to 66 in. wide and in the following thicknesses: $\frac{1}{64}$, $\frac{1}{32}$, $\frac{1}{16}$ in. (100 ft. long); $\frac{1}{8}$ in. (50 ft. long); $\frac{1}{4}$ in. (25 ft. long). It is also available as a cut gasket, die-cut to specifications.

Indicating, Contact-Making Pyrometer

An indicating, contact-making pyrometer, known as the Alnor Pyrotac, is now being made by the Illinois Testing Laboratories, Inc., 420 N. La Salle Street, Chicago.

It is available either as a single circuit instrument or with a motor-operated selector switch.

The pyrometer is designed to improve the instrumentation of a diesel or gas engine. It may, for example, be used to sound an alarm and automatically shut down the engine in case of an excessively high exhaust gas temperature for any one cylinder. In such installations, the instrument is connected in turn to the thermocouple in the exhaust stem from each cylinder once every minute. Should the exhaust temperature of any one cylinder be above the pre-determined maximum, the alarm will sound and the engine will be shut down. The pointer on the selector switch will stop at the number of the offending cylinder, thus facilitating the location of the source of trouble.

The automatic features of the Pyrotac and motor operated switch do not interfere with the customary use of an exhaust temperature pyrometer. By watching the pyrometer pointer for a period of one minute, the operating engineer can determine if one or more cylinders is out of balance. Because the switch is of the overlapping type (i.e., the new thermocouple is connected before the old thermocouple circuit is broken), the pyrometer pointer does not drop then to ambient temperatures between readings. Therefore, an out of balance condition is indicated by an appreciable motion of the pointer. If the operator desires to log the exhaust temperature of each cylinder, he may stop the selector switch at any desired cylinder by pressing a spring loaded button on the meter panel and then read the temperature. Releasing the button puts the instrument back in service continuously protecting the engine. When it is impractical to shut an engine down because of excessive exhaust temperature, the alarm feature may be used to warn the engineman of the dangerous conditions so that he can take the necessary steps to protect his equipment.

In a multiple engine plant, the Pyrotac could be connected to a couple in the common exhaust of each engine and thus sound an alarm if any one engine were overloaded. Similarly, a Pyrotac with a suitable range could be connected to the thermocouples in generator windings or bearings.

The meter movement in the Pyrotac is the same as that in Alnor pyrometers. The contact-making mechanism is non-electronic. The motor-operated switch is a comparatively radical design, but it has now had years of field use.

(Turn to page 160)

Applications of the Alnor Pyrotac to an engine exhaust, engine main bearing and generator windings

NEWS

A.S.M.E. Annual Meeting To Be Held at Atlantic City

Chalfonte-Haddon Hall, Atlantic City, N.J., will be the headquarters for the 1951 annual meeting of the American Society of Mechanical Engineers which will be held November 26 to 30, inclusive. A registration fee of $5 will be charged nonmembers attending. For student nonmembers the fee will be $1. The banquet will be at 6:45 p.m., Wednesday, November 28. The program, in part, is as follows.

MONDAY, NOVEMBER 26
2:30 p.m.

Gas Turbine Power (II)—Power (I)

The Gas-Turbine's Contribution to Gas-Line Pumping, by T. J. Putz, locomotive and turbine engineering, Westinghouse Electric Corp.

A 5,000-hp. Gas-Turbine Power Plant, by Bruce O. Buckland, engineer, and Donald C. Berkey, section engineer, gas turbine engineering division, General Electric Co.

TUESDAY, NOVEMBER 27
9:30 a.m.

Panel Discussion: Effect of the Lubricating Oil Upon Diesel and Gas-Engine Performance:

Lubrication, by John Gibb, Socony Vacumm Oil Co.

Bearings, by E. W. Crankshaw, Cleveland Graphite Bronze Co.

Engines, by George Steven, Worthing Pump & Machinery Corp.

Filters, by F. Lee Townsend, manager, William W. Nugent & Co.

Liners and Pistons, by Stuart Nixon, Sealed Power Corp.

WEDNESDAY, NOVEMBER 28
2:45 p.m.
Railroad (I)

Economic and Efficient Lubrication of Waste Packed Journals, by L. D. Grisbaum, chief engineer, Railway Service & Supply Co.

Economic Study of Roller Bearings on Freight Cars, by O. J. Horger, chief engineer, Railway Division, Timken Roller Bearing Co.

THURSDAY, NOVEMBER 29
9:30 a.m.

Railroad (II)—Oil and Gas Power (IV)

Operating Experience of the Talgo Train, by Jerry M. Gruitch, director, research and development, American Car & Foundry Co.

Development of the General Motors Two-Cycle Railway Diesel Engine, by E. W. Kettering, chief engineer, Electro-Motive Division, General Motors Corp.

2:30 p.m.

Railroad (III)—Materials Handling (IV)

Progress in Railway Mechanical Engineering (Report of Committee RR-6 Survey), by T. F. Perkinson, committee chairman, manager, Commercial Engineering Division, Transportation Division, General Electric Co.

Symposium — Railroads and Highway Trailers—An Economic Solution to a Difficult Problem, by George L. Goebel, mechanical engineer, New York, New Haven & Hartford; H. R. Sampson, vice-president, Chicago & Eastern Illinois, and E. F. Ryan, president, Rail-Trailer.

Freight-Car-Parts Advisory Committee

The National Production Authority, U. S. Department of Commerce, has announced the following as members of the Railroad Freight Car Component Parts Industry Advisory Committee:

C. R. Auld, assistant to vice-president Railway, Steel Spring Division, American Locomotive Company, Latrobe, Pa.; Fred P. Biggs, president, American Brake Shoe

(Continued on page 142)

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of June 1951	Month of June 1950	6 months ending with June 1951	6 months ending with June 1950
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	23,566	29,128	157,795	165,348
3-06	Total, Diesel-electric	22,744	17,100	128,600	97,696
3-07	Total, electric	836	826	4,962	4,843
3-04	Total, locomotive-miles	47,147	47,054	291,378	267,911
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,706	1,638	10,345	9,040
4-06	Empty, total	871	865	5,169	4,904
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	42,233	48,949	271,832	268,252
6-02	Total in oil-burning steam locomotive trains	11,950	14,363	73,280	70,246
6-03	Total in Diesel-electric locomotive trains	63,845	48,502	359,819	275,105
6-04	Total in electric locomotive trains	2,298	2,203	13,627	12,679
6-06	Total in all trains	120,333	114,025	718,653	626,395
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.04	1.05	1.05	1.05
10-02	Loaded freight car-miles	40.1	38.9	39.5	37.7
10-03	Empty freight car-miles	20.5	20.6	19.7	20.4
10-04	Total freight car-miles (excluding caboose)	60.6	59.5	59.2	58.1
10-05	Gross ton-miles (excluding locomotive and tender)	2,828	2,713	2,741	2,611
10-06	Net ton-miles	1,331	1,234	1,282	1,175
12	Net ton-miles per loaded car-mile (M-211)	33.2	31.7	32.5	31.2
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	66.2	65.4	66.7	64.8
14	Averages per train hour (M-211):				
14-01	Train miles	17.1	16.9	16.9	17.0
14-02	Gross ton-miles (excluding locomotive and tender)	47,777	45,329	45,791	43,805
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	45.9	46.8	46.1	43.3
14-02	All	43.8	43.8	44.0	40.3
15	Average net ton-miles per freight car-day (M-240)	962	907	953	814
17	Per cent of home cars of total freight cars on the line (M-240)	39.2	39.6	36.6	45.4

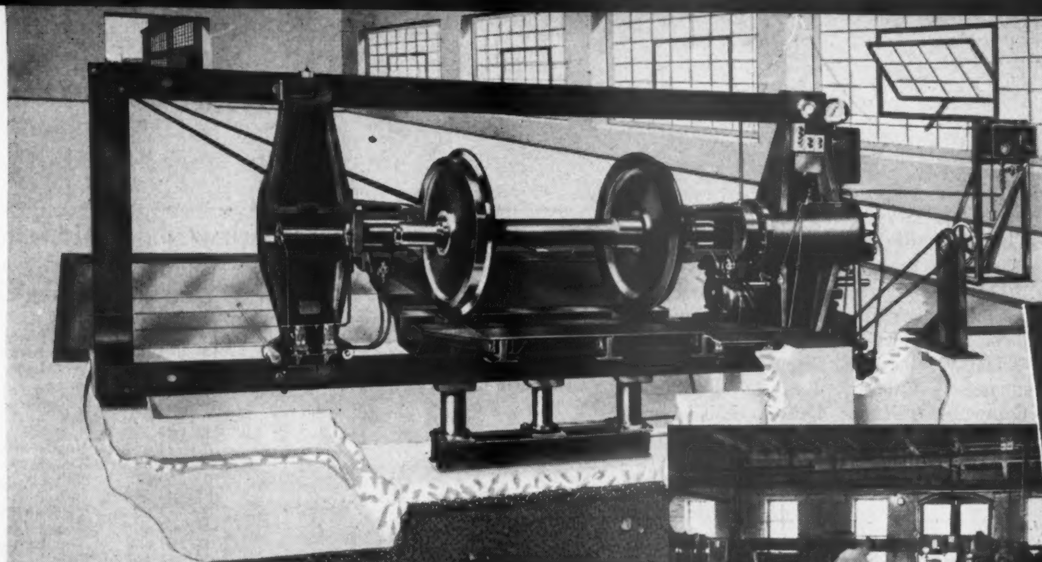
PASSENGER SERVICE (DATA FROM I.C.C. M-213)

Item No.		Month of June 1951	Month of June 1950	6 months ending with June 1951	6 months ending with June 1950
3	Road motive-power miles (000):				
3-05	Steam	9,601	12,214	64,126	68,236
3-06	Diesel-electric	16,279	14,404	94,835	84,322
3-07	Electric	1,613	1,608	9,697	9,518
3-04	Total	27,493	28,226	168,658	162,076
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	269,456	271,043	1,630,372	1,552,578
4-09	Total in coal-burning steam locomotive trains	49,409	63,968	336,856	346,987
4-10	Total in oil-burning steam locomotive trains	33,232	38,487	199,615	210,325
4-11	Total in Diesel-electric locomotive trains	169,813	151,703	990,609	892,371
12	Total car-miles per train-miles	9.61	9.47	9.51	9.35

YARD SERVICE (DATA FROM I.C.C. M-215)

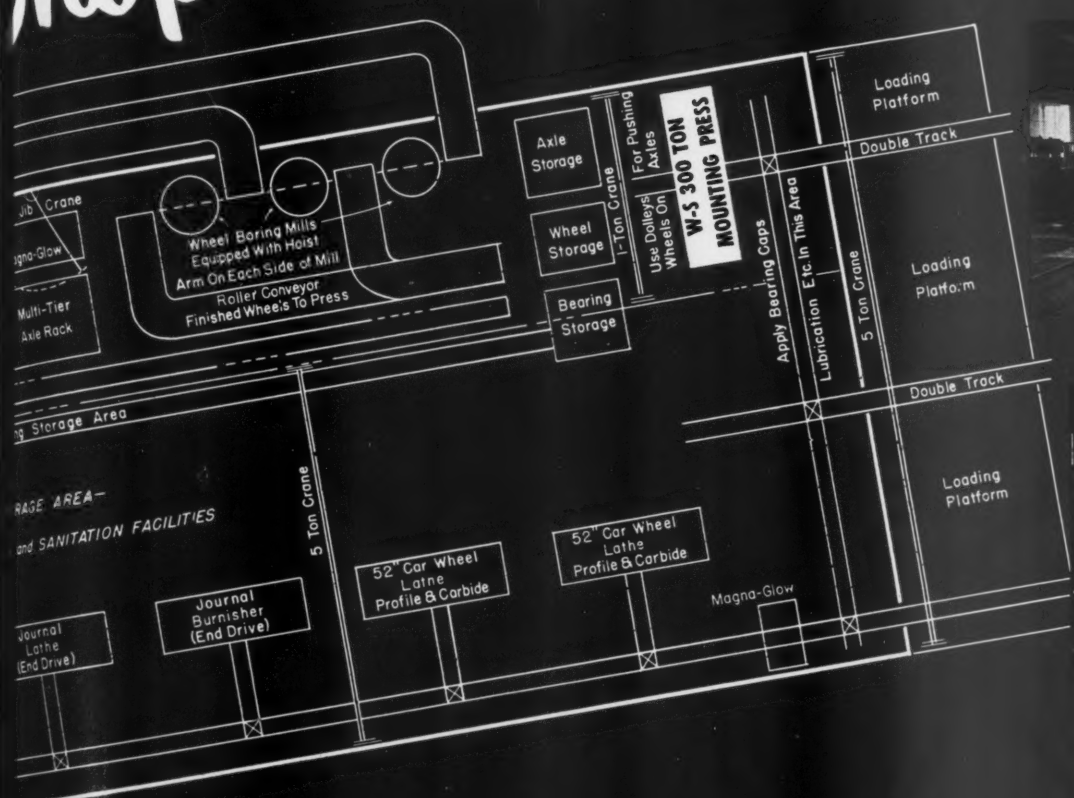
Item No.		Month of June 1951	Month of June 1950	6 months ending with June 1951	6 months ending with June 1950
1	Freight yard switching locomotive-hours (000):				
10-1	Steam, coal-burning	1,138	1,396	7,687	8,342
1-02	Steam, oil-burning	229	255	1,459	1,363
1-03	Diesel-electric[1]	2,906	2,473	17,346	14,132
1-06	Total	4,297	4,151	26,650	23,994
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	43	57	302	364
2-02	Steam, oil-burning	12	13	78	77
2-03	Diesel-electric[1]	240	227	1,436	1,331
2-06	Total	328	330	2,017	1,974
3	Hours per yard locomotive-day:				
3-01	Steam	7.4	8.2	8.0	7.6
3-02	Diesel-electric	17.1	17.6	17.5	17.3
3-05	Serviceable	14.2	14.2	14.5	13.8
3-06	All locomotives (serviceable, unserviceable and stored)	12.2	12.1	12.5	11.5
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.74	1.76	1.78	1.83
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.76	0.76	0.77	0.79

[1]Excludes B and trailing A units.



WATSON-STILLMAN
300 TON STRAIGHT-THROUGH
WHEEL MOUNTING PRESS

Shop



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REPRESENTATIVES

Chicago 4, Ill.	W. R. Walsh	St. Paul 4, Minn.	Anderson Machine Tool Co.
Denver 2, Colo.	Overgard Machine Tool Co.	San Francisco 5, Calif.	Overland Supply Co.
New York 17, N. Y.	Eastern Railway Supplies, Inc.	Washington 5, D. C.	Ralph Payne

9-1-3

(Continued from page 138)

Company, Brake Shoe & Casting Division, New York; J. Ross Drever, assistant to vice-president, American Steel Foundries, Chicago; R. J. Brewniak, vice-president, Apex Railway Products Company, Chicago; Chas. E. Stevens, Jr., works manager, Chicago Railway Equipment Company, Chicago; Payson Smith, president, Illinois Railway Equipment Company, Chicago; S. T. Mendez, manager of District Office, W. H. Miner, Inc., Chicago; George L. Green, vice-president, Spring Packing Corp., Chicago; S. L. Beymer, vice-president, Standard Railway Equipment Manufacturing Company, Chicago; Charles L. Moorman, vice-president, Equipment Steel Products Division, Union Asbestos & Rubber Co., Chicago, and E. E. Robbins, vice-president, Youngstown Steel Door Company, Chicago.

SUPPLY TRADE NOTES

General Motors Corporation. — The first General Motors diesel locomotive built outside the North American continent was put into transcontinental passenger service in Australia recently. The diesel has 1,500 hp., is 61 ft. long and 14 ft. high, weighs 108 tons, has a maximum speed of 90 m.p.h., a maximum tractive force of 50,000 lb. and an axle load of 18 tons. The low axle loading permissible on the Australian tracks and bridges necessitated considerable redistribution of weight from the American design of the F type locomotive as well as the use of six-wheel trucks instead of the American design of four wheel trucks in this type locomotive. No train heating boilers are required. The space normally used for this equipment is used to house special engine-room air-filtering equipment made necessary by desert operating conditions. The locomotive carries 1,500 gallons of fuel oil, sufficient for its 1,051-mile run. It was built by Electro-Motive's Australian affiliate, the Clyde Engineering Company, Pty. Ltd., at Clyde, N. S. W. Power plant, transmission equipment and controls were supplied by Electro-Motive from LaGrange.

◆

Pullman Company.—*George W. Bohannon*, has resigned as chief mechanical officer of the Chicago & North Western and has been appointed to fill the newly established position of manager, purchases and stores for the Pullman Company.

◆

Lincoln Electric Company.—*L. K. Stringham* has been appointed chief engineer for the Lincoln Electric Company of Cleveland. *G. G. Landis* continues as engineering vice-president.

Mr. Stringham was graduated from Cornell University as an electrical engineer and became associated with Lincoln Elec-

(Continued on page 144)

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE OCTOBER ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of units	Horse-power	Service	Builder
Atchison, Topeka & Santa Fe	10[1]	1,600	Switchers	Fairbanks, Morse
	14[1]	1,200	Switchers	Fairbanks, Morse
Canadian Pacific	6A	1,500		Canadian Loco.
	6B	1,600		Canadian Loco.
	6A	1,500		Gen. Motors Diesel, Ltd
	11B	1,500		Gen. Motors Diesel, Ltd.
	3	1,500	Road switch	Gen. Motors Diesel, Ltd.
	6	1,000	Switch	Montreal Loco.
	12	660	Switch	Montreal Loco.
Erie	3[2]	1,500	Gen. purpose	Electro-Motive
	2[2]	1,200	Yard switch	Electro-Motive
	4[2]	1,600	Gen. purpose	Alco-G. E.
	4[2]	1,600	Gen. purpose	Baldwin-Lima-Hamilton
Maine Central	1[3]	1,000	Switch	Alco-G. E.
Missouri-Kansas-Texas	10[3a]	1,200	Switchers	Electro-Motive
	10[3a]	1,200	Switchers	Baldwin-Lima-Hamilton
Montour	4[4]	1,200		Electro-Motive
New York Central	32A[5]	1,500	Freight	Electro-Motive
	32B[5]	1,500	Freight	Electro-Motive
	40[5]	1,200	Yard switch	Electro-Motive
	20[5]	800	Yard switch	Electro-Motive
	35[5]	1,600	Road switch	Alco-G. E.
	43[5]	1,000	Yard switch	Alco-G. E.
	18[5]	1,200	Yard switch	Baldwin-Lima-Hamilton
	17[5]	1,200	Yard switch	Fairbanks, Morse
Pittsburgh & Lake Erie	12[5]	1,500	Road switch	Electro-Motive
	10[5]	1,200	Yard switch	Electro-Motive
	2A[5]	2,250	Passenger	Alco-G. E.
St. Louis-Southwestern	4[6]	1,600	Road switch	Alco-G. E.
Union	11[7]	1,200	Switchers	Electro-Motive

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Atlantic Coast Line	2[8]	50-ton "Unicel" box	Pressed Steel Car
Bessemer & Lake Erie	500	70-ton ore	Greenville Steel Car
Canadian Pacific	1,000	50-ton box	Canadian Car & Fdry.
	300	50-ton automobile	Canadian Car & Fdry.
	25	70-ton bagg.-exp.	Canadian Car & Fdry.
	1,200	50-ton box	Company shops
	400	50-ton freight refrigerator	National Steel Car
	300	70-ton covered hopper	National Steel Car
	350	50-ton box	National Steel Car
	25	50-ton express refrigerator	National Steel Car
	300	70-ton hopper	Eastern Car
	300	70-ton gondola	Eastern Car
Duluth, Missabe & Iron Range	250	70-ton hopper	Pressed Steel Car
Grand Trunk Western	350	50-ton box	American Car & Fdry.
	250	70-ton hopper	American Car & Fdry.
Great Northern	950[9]	50-ton box	Company shops
	50[9]	50-ton express refrigerator	Pacific Car & Fdry.
Louisville & Nashville	250	50-ton box	Pullman-Standard
Norfolk & Western	1,000	70-ton gondola	Virginia Bridge
Virginian	1,000	50-ton hopper	Bethlehem Steel

[1] Delivery scheduled for 1952.
[2] For delivery between January and May, 1952.
[3] Delivery scheduled for December.
[3a] This is orher for 20 locomotives reported in October but not divided as to builders.
[4] Delivery of these first non-steam locomotives for the road scheduled for 1952. Estimated cost, $425,000.
[5] Deliveries expected to begin in the second quarter of 1952 and to be completed early in 1953.
[6] For December delivery. Estimated cost per unit, $145,711.
[7] For delivery early in 1952. Estimated cost of each, $107,000.
[8] Delivery expected in the first quarter of 1952. Will be used exclusively on the A.C.L. for test purposes.
[9] Delivery expected during second quarter of 1952. The box cars will cost approximately $6,175,000; the refrigerator cars, approximately $1,300,000.

NOTES:

Army Transportation Corps.—The Army Transportation Corps is now procuring standardized railroad box cars for all four of the armed services. Replacing the former practice whereby each service procured railroad equipment of its own design, the single procurement method, which extends to all railroad cars and locomotives, is said to have aided standardization of government-used railroad equipment. A total of 212 50-ton box cars were recently procured by the Marietta Transportation Corps Depot, Marietta, Pa., from the Michigan City, Ind., plant of the Pullman-Standard Car Manufacturing Company. Of the cars—all "PS-1" units—150 were delivered to the Army, 39 to the Navy, 13 to the Air Force and 10 to the Marine Corps. The cars will be used principally to replace wornout equipment in intra-plant service within domestic military installations.

Minneapolis, St. Paul & Sault Ste. Marie.—The board of directors has authorized purchase of 20 diesel-electric locomotives costing about $3,200,000, and the building of 600 freight cars of various types in connection with its 1952 equipment program. The cars are to be built in the road's Fond du Lac, Wis., shops.

SUMMARY OF MONTHLY HOT BOX REPORTS

Month	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes: System	Foreign	Total	Miles per hot box car set off between division terminals
July, 1950	2,745,932,894	....	.....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,782	5,631	13,737	19,368	155,590
June, 1951	2,874,873,495	7,074	15,376	22,450	128,057

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- **MAXIMUM SOUND OUTPUT**—Up to 117 decibels
- **LOWEST AIR CONSUMPTION**—50% Lower than any other Air Horn for Same Sound Output
- **TRUE MUSICALLY SHAPED HORNS**—To Produce Clearer Tones Like the Sound of the Steam Whistle
- **SIMPLE DIAPHRAGM**—A Flexible Single Leaf Diaphragm Interchangeable in all Horns. Permanent Fixed Adjustment. Maximum Life.

The simple, trouble free, patented power chamber and the specially shaped horns give you safe, pleasing and dependable performance without the need for frequent adjustments and service.

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tric in 1933. He has worked continuously in the engineering department and for the past two years has been director of welding development.

◆

AMERICAN HOIST & DERRICK CO.—*Peerless Equipment Company* has been appointed exclusive railroad supply agent and will handle American Hoist business with practically all railroads that headquarter in the Chicago area.

◆

STANDARD RAILWAY EQUIPMENT MANUFACTURING COMPANY.—*Donald Petersen* has been appointed vice-president in charge of production of the *Standard Railway Equipment Manufacturing Company,* with headquarters in Chicago. He will direct all manufacturing activities at the company's plants in Hammond, Ind., New Kensington, Pa., and Lachine, Que.

Mr. Petersen came to Standard from Carnegie-Illinois Steel, where he spent five years in the Gary works and in Pittsburgh, later being on the staff of the vice-president in charge of industrial relations. He joined Standard Railway in 1944 as assistant to the president, and since that time has had an active management role in production

Donald Petersen

and operations. He was elected assistant vice-president a year ago.

Standard Railway Equipment Company is going ahead with certain units of its long-range modernization and expansion program for its Hammond, (Ind.) plant, although the cost, under today's conditions, may run somewhat higher than the original estimate of between $2½ million and $3 million. The program anticipates an additional 150,000 sq. ft. of factory floor space plus greater utilization of present space through modernization.

◆

H. K. PORTER COMPANY.—The H. K. Porter Company has acquired the *Buffalo Steel Company,* thus increasing its steel production capacity to over 200,000 tons.

◆

WORTHINGTON PUMP & MACHINERY CORP.—*Charles E. Wilson,* sales vice-president of the Worthington Pump & Machinery Corp., has been appointed a West Coast consultant on sales problems.

Mr. Wilson retired from his former position and activities in corporation affairs on October 1, but will continue in a consulting capacity at Worthington's offices in Los Angeles, San Francisco, Seattle and Salt Lake City.

◆

APEX RAILWAY PRODUCTS COMPANY.—*Edward T. Doherty,* president and director of Apex Railway Products Company, has been elected to the newly created position of chairman of the board. *Leo F. Duffy,* vice-president of the Youngstown Steel Door Company, has become president and director of Apex Railway Products.

Mr. Duffy is a graduate of Corpus Christi College, Galesburg, Ill. (1916). After serv-

Leo F. Duffy

ing in the U. S. Army in World War I, he was employed by the Chicago, Burlington & Quincy in various engineering positions. In 1926 he joined the Chicago Pneumatic Tool Company in its railroad sales division. In 1937 he became associated with Youngstown Steel Door.

◆

BLACK & DECKER MANUFACTURING CO.—*John F. Spaulding* has been appointed sales manager of Black & Decker, Towson, Md. Mr. Spaulding will supervise the sales of Black & Decker and Home Utility tools to distributors in the United States and Canada.

◆

IRVING SUBWAY GRATING COMPANY.—*Guilford S. Turner, Inc.,* has been appointed national sales representative for the Irving Company's Safkar grating products.

◆

AMERICAN BRAKE SHOE COMPANY.—*Pearce D. Smith,* sales representative for the National Bearing division of American Brake Shoe, has transferred from Pittsburgh to company headquarters, 230 Park avenue, New York. *Edward J. Roesch* has been appointed superintendent of the Meadow Lands, Pa., plant of the Brake Shoe and Castings division, and *Thomas P. Wallace* has been appointed superintendent of the division's plant at Buffalo, N. Y. *Thomas Baldwin,* formerly superintendent of the Meadow Lands plant, has retired.

Arthur N. Dugan, who has retired as vice-president of the National Bearing Division as announced in the October issue, started his career as a clerk with the Erie after his graduation from Rider College. In 1914 Mr. Dugan went into sales work, and later became vice-president of the Bronze Metal Company of New York. He became vice-president of National Bearing Metals Corporation in 1927 when that concern was formed. Later National Bearing Metals Corporation became a subsidiary, and then a division of Brake Shoe.

◆

ALLIS-CHALMERS MANUFACTURING COMPANY.—The electrical and mechanical power departments of Allis-Chalmers have been combined into a power department under the management of *R. M. Casper. F. W. Bush* has been appointed assistant manager in charge of the electrical section; *C. C. Jordan,* assistant manager in charge of the mechanical sections; *R. N. Miers,* manager of the steam turbine section; and *C. R. Braun,* assistant to Mr. Casper.

◆

PITTSBURGH STEEL COMPANY—William G. Gary, whose appointment as manager of railway sales for the Pittsburgh Steel Company was announced in the October issue, is a graduate of Pennsylvania State College. Immediately upon his graduation he joined the Lehigh Valley as a special apprentice, serving at different locations on the system. He later became foreman,

William G. Gray

and then general foreman in various L.V. shops, ultimately becoming special engineer at Bethlehem, Pa. He subsequently joined the Union Pacific at Omaha as engineer of freight car design; the Association of American Railroads as an assistant mechanical engineer, and the Virginian as master mechanic. He went with Pittsburgh Steel in 1944 as railway development engineer on tubular railway axles.

◆

TIMKEN ROLLER BEARING COMPANY—George T. Humphrey, Jr., has been appointed assistant general manager of the service sales division of the Timken Roller Bearing Company, with headquarters at Canton, Ohio. Mr. Humphrey formerly was assistant branch manager of the service sales division of Dallas.

◆

BALDWIN-LIMA-HAMILTON CORPORATION—About next January 1 the sales, engineering and manufacturing activities of the wholly owned subsidiary of Baldwin-Lima-Hamilton — the Whitcomb Locomotive


MINER
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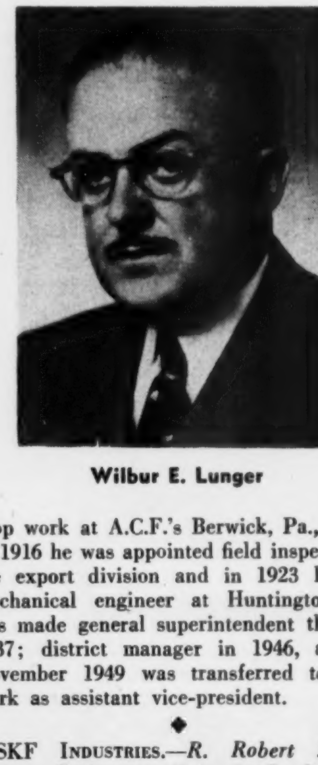
Company, of Rochelle, Ill.—will be transferred to the Eddystone, Pa., plant. This contemplated transfer will bring together at Eddystone all locomotive manufacture where ample facilities are available. The present Whitcomb plant at Rochelle will be used to provide space for expansion of the manufacturing activities of the Austin-Western Company, also a B.-L.-H. subsidiary.

◆

American Car & Foundry Co.—*Wilbur E. Lunger* has been elected a vice-president of the American Car & Foundry Co., reporting to *R. W. Ward*, vice-president in charge of production. *Robert M. Noel* has been appointed sales agent at Chicago, reporting to *J. H. VanMoss*, western sales manager. Mr. Noel will represent A.C.F. in general railroad sales throughout the midwest territory which is under the general supervision of *P. A. Hollar*, vice-president in Chicago.

Mr. Lunger, a native of Danville, Pa., was formerly assistant vice-president in the production department. He studied engineering and for two years was trained in shop work at A.C.F.'s Berwick, Pa., plant. In 1916 he was appointed field inspector in the export division and in 1923 became mechanical engineer at Huntington. He was made general superintendent there in 1937; district manager in 1946, and in November 1949 was transferred to New York as assistant vice-president.



Wilbur E. Lunger

◆

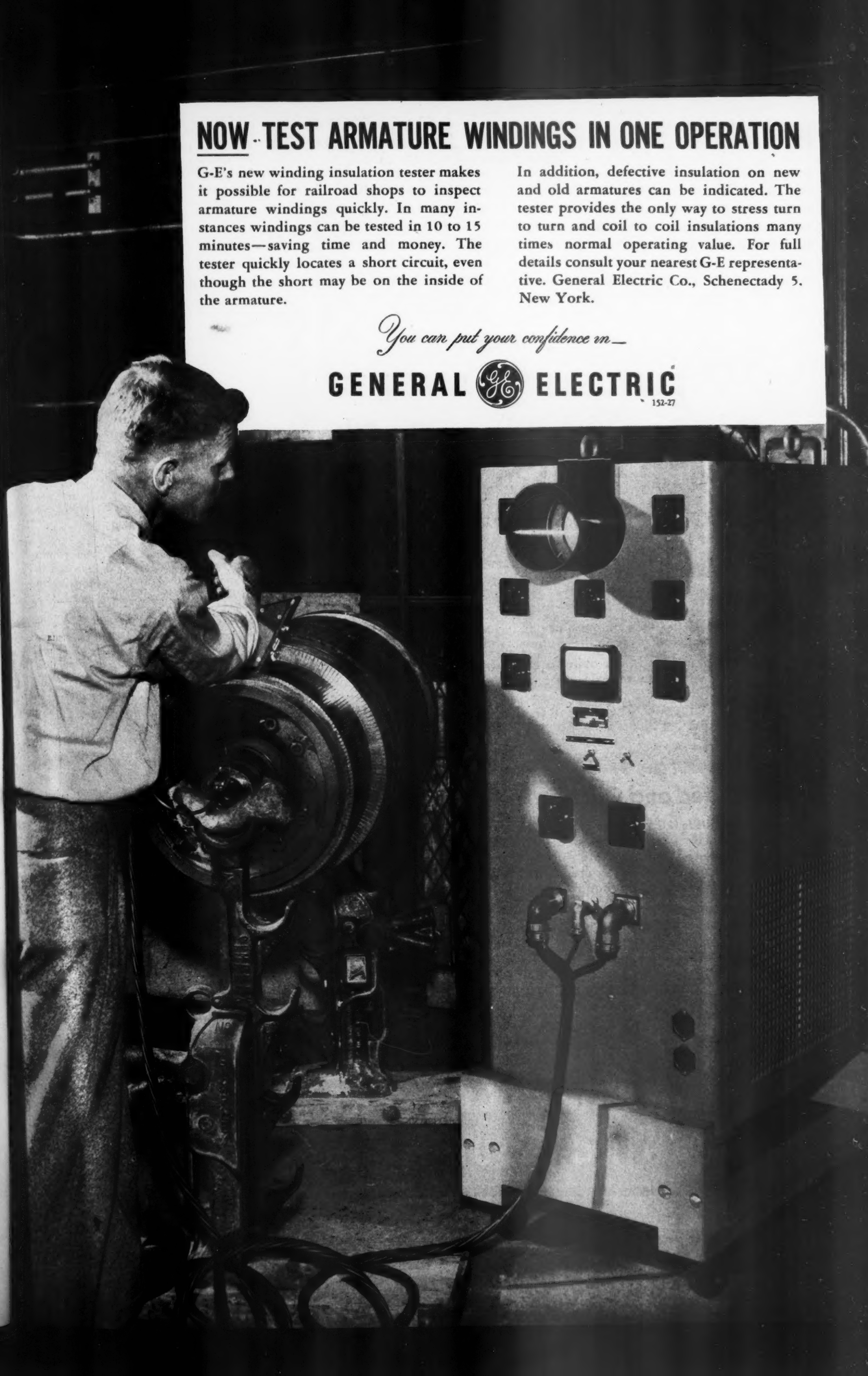
SKF Industries.—*R. Robert Zisette, Gunnar Palmgren, Eric C. Brodin,* and *Karl Kesselring* have been elected vice-presidents of SKF, with headquarters at Philadelphia. Mr. Zisette is in charge of sales, advertising and market research; Mr. Brodin, in charge of manufacturing development; Mr. Palmgren, in charge of engineering and research, and Mr. Kesselring, in charge of production.

◆

Safety Car Heating & Lighting Co.—*Henry T. Stetson*, formerly vice-president of Safety, has been elected president to succeed Charles W. T. Stuart, deceased.

◆

Camel Sales Company.—*Arthur J. Doyle* and *James D. Ryan* have been elected vice-presidents of the Camel Sales Company, wholly owned subsidiary of the


NOW TEST ARMATURE WINDINGS IN ONE OPERATION
G-E's new winding insulation tester makes it possible for railroad shops to inspect armature windings quickly. In many instances windings can be tested in 10 to 15 minutes—saving time and money. The tester quickly locates a short circuit, even though the short may be on the inside of the armature.
In addition, defective insulation on new and old armatures can be indicated. The tester provides the only way to stress turn to turn and coil to coil insulations many times normal operating value. For full details consult your nearest G-E representative. General Electric Co., Schenectady 5. New York.
You can put your confidence in—
GENERAL ELECTRIC
152-27

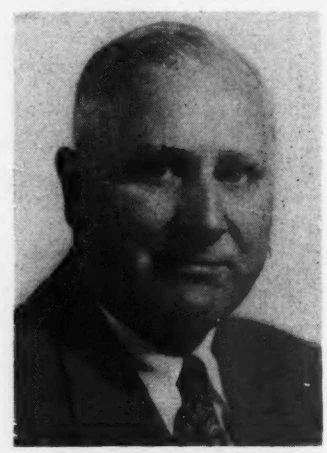
Youngstown Steel Door Company. Mr. Doyle has resigned as assistant vice-president of the parent firm. Mr. Ryan formerly was assistant vice-president of Camel Sales. *Emmett P. Dowling, Jr.*, formerly an employee of Youngstown Steel Door, has been elected an assistant vice-president of Camel.

Mr. Doyle began his career as draftsman for the Erie in 1929 and joined the Advisory Mechancial Committee in 1930.

Arthur J. Doyle

He became associated with Youngstown Steel Door in 1937 as a draftsman and in 1941 was promoted to sales engineer. In November 1944 he was elected assistant vice-president.

Mr. Ryan began his business career with Lawrence Stern & Co. as a bond salesman. In 1928 he joined the Ryan Car Company as a mechanic and later was appointed general manager and treasurer. From 1940



James D. Ryan

to 1944 he was shop supervisor in the small arms ammunition plant of the DuPont Company at Denver. Mr. Ryan joined the sales force of the Camel Sales Company as assistant vice-president.

Mr. Dowling worked on special assignments for the government out of Washington, D.C., during World War II. He resigned that position in 1946 to join Youngstown Steel Door.

◆

United States Steel Corporation.—*Orville F. Figley*, Chicago district manager for United States Steel, has been named assistant to vice-president—sales. *Keith P. Rindfleisch*, Pittsburgh district manager,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Yes, you can cut your train-washing time from hours to minutes with a Whiting Train Washer. You can wash over 300 cars a day. You can eliminate lay-up time caused by slow expensive hand-washing crews. You can operate the Whiting Train Washer at speeds up to 80 feet a minute. Your coach yards will remain dry so undercar maintenance will not be delayed. You can wash an entire train in a matter of minutes with this modern method of train washing.
The Whiting Train Washer is obtainable in single- or multiple-unit installations that can be supplied with an extra attachment for washing roofs. Write for Bulletin CW-C-409 for more information.
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succeeds Mr. Figley at Chicago, and *Wesley N. Gordon*, manager of the alloy division, succeeds Mr. Rindfleisch.

United States Steel Supply Company.—*Arthur I. Gibson* has been appointed manager of the newly formed sheet and strip division of the general sales department of United States Steel Supply Company. Mr. Gibson was formerly product representative for the company's sheet and strip division in Pittsburgh.

Vapor Heating Corporation— *J. T. Elwood* has been appointed sales representative for the Vapor Heating Corporation, of Chicago, succeeding the late Dave J. Jones.

Copperweld Steel Company.—The Copperweld Steel Company, Glassport, Pa., has purchased all outstanding stock of the *Flexo Wire Company*, Oswego, N.Y. The latter will be operated as a wholly owned subsidiary of Copperweld.

Chicago Steel Service Company.—*Walter H. Creber, Jr.*, has been appointed manager of sales of Chicago Steel Service.

Thomas A. Edison, Inc.—*F. C. Anderson* has been appointed chief engineer of the Edison Storage Battery Division of Thomas A. Edison, Inc., to succeed the late Walter H. Patterson.

Mr. Anderson, formerly assistant chief engineer of the division, first joined the firm in 1931. In July 1946 he resigned to become chief engineer of the Storage Battery division of Baker & Co., but rejoined Edison last July.

Flintkote Company.—The Flintkote Company, New York, has appointed the *Ellcon Company*, 30 Church street, New York, as special manufacturer's sales representatives to the transportation industry for Flintkote products in the eastern section of the United States.

Spring Packing Corporation—*George L. Green*, vice-president in charge of sales of the Spring Packing Corporation, has been elected executive vice-president, with headquarters in Chicago.

Obituary

Charles W. T. Stuart, president of the Safety Car Heating & Lighting Co., died October 1 in the United Hospital, Port Chester, N.Y. Mr. Stuart was 63 years old. He was born in Philadelphia and was a graduate of the Drexel Institute of Technology. He began his business career in 1908 with the Baldwin Locomotive Works and from 1909 to 1924 worked in the motive-power department of the Pennsylvania. In the latter year he joined Safety Car Heating & Lighting as a sales representative. He was appointed southeastern district manager in 1933 and also Philadelphia, manager of the Vapor Car Heating Company. Mr. Stuart was appointed assistant to the president of Safety in 1943, and was elected vice-president in charge of sales in 1946. He was elected executive vice-president in 1947 and president in 1948.

Arthur B. McCoy, St. Louis representative for the steel floor division of the Great Lakes Steel Corporation, died on September 25 in St. Louis.

John P. Roberts, assistant general manager of the Service Sales Division of the Timken Roller Bearing Company, was killed in an automobile accident near Spruce Pine, N.C., on September 19.

PERSONAL MENTION

General

G. J. Flanagan has been appointed assistant superintendent of equipment of the New York Central System, with headquarters at New York.

Bruce C. Gunnell, chief mechanical engineer of the Southern System at Washington, D. C., has been appointed acting superintendent motive power of the Eastern lines at Charlotte N. C.

(Continued on page 154)

(Continued from page 150)

John C. Stump, assistant chief mechanical officer, has been appointed chief mechanical officer of the Chicago & North Western, with headquarters at Chicago.

Francis L. Morrison, traveling electrical inspector for the Illinois Central, has been appointed general air-brake engineer, with headquarters at Chicago.

E. F. Tuck, master mechanic, Eastern division, St. Louis-San Francisco, at Springfield, Mo., has been appointed assistant superintendent of motive power. Mr. Tuck entered railroad service as an apprentice machinist in the Cleburne, Tex., shops of

E. F. Tuck

the Santa Fe. He came to the Frisco in 1922 as enginehouse foreman at Kansas City and later served as general foreman at Memphis, and in the west locomotive shops in Springfield. He was named master mechanic of the Eastern division in 1947

Angelo J. Pichetto, general air-brake engineer of the Illinois Central, has retired after 47 years of service with the railroad.

W. C. Wardwell, assistant to general superintendent equipment of the New York Central System, has been appointed superintendent of equipment, with jurisdiction over the territory Buffalo and East and the Boston & Albany, with headquarters as before at New York.

George R. Andersen, superintendent, car department of the Chicago & North Western has been appointed assistant chief mechanical officer with headquarters at Chicago.

R. F. Batchman has been appointed assistant superintendent of equipment of the New York Central System with headquarters at New York. Mr. Batchman was formerly superintendent diesel shops of the B. & A. at West Springfield, Mass.

Diesel

J. A. Wetzel has been appointed superintendent of shop (diesel) of the New York Central at West Springfield, Mass.

M. B. Adams has been appointed assistant supervisor of diesel engines for the Atchison, Topeka & Santa Fe and the Panhandle & Santa Fe, with headquarters at Amarillo, Tex. Mr. Adams will have

jurisdiction over the Plains division of the P.&S.F. and the Panhandle division of the A.T.&S.F.

J. S. Duck has been appointed diesel supervisor—system of the Illinois Central, with headquarters at Chicago.

Electrical

B. D. Allison has been appointed electrical engineer (fixed property) of the Chicago & North Western, with headquarters at Chicago. Mr. Allison will be in charge of the design, construction and maintenance of fixed property electrical power and light facilities.

L. E. Legg has been appointed electrical engineer (equipment) of the Chicago & North Western, with headquarters at the Chicago shops.

Car

Clarence P. Nelson, general foreman of the Chicago & North Western, has been appointed assistant superintendent, car shops, at Chicago.

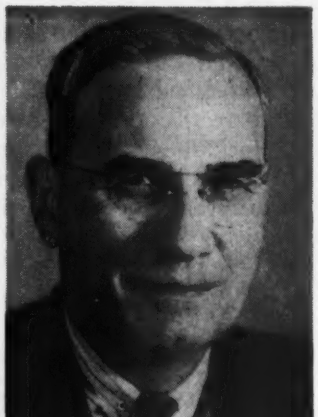
Walter C. Barrer, assistant superintendent, car shops of the Chicago & North Western, has been appointed superintendent, car department, at Chicago.

Shop and Enginehouse

Walter L. Huebner, master mechanic of the Atchison, Topeka & Santa Fe at Chicago, has been appointed superintendent of shops at Barstow, Calif.

Master Mechanics and Road Foremen

David Beath, master mechanic of the Manitoba district of the Canadian Pacific at Winnipeg, Man., has retired. Mr. Beath entered the employ of the Canadian Pacific in 1901 at North Bay, Ont. Between 1937 and 1943 he was master mechanic at



D. Beath

Winnipeg, Moose Jaw, and Calgary. He served also at Kenora, Ont., as division master mechanic and became master mechanic of the Saskatchewan district at Moose Jaw in 1944. In 1947 he was transferred to Winnipeg.

ARTHUR T. REYNOLDS, division master mechanic of the Canadian Pacific at Sudbury, Ont., has been transferred to Kenora, Ont.

J. F. COONEY has been appointed assistant master mechanic of the New York Central at Syracuse, N. Y.

R. CHRISTIE has been appointed division master mechanic of the Smiths Falls division of the Canadian Pacific at Smiths Falls, Ont.

H. W. ALLMAND, division master mechanic of the Smiths Falls division of the Canadian Pacific at Smiths Falls, Ont., has been transferred to the Laurentian division at Montreal.

R. J. PARSONS, master mechanic of the New York Central at Avis, Pa., has been transferred to Albany, N. Y.

J. J. RABY, who has been appointed master mechanic of the Manitoba district of the Canadian Pacific at Winnipeg, Man., as announced in the October issue, entered the employ of the Canadian Pacific at Fort William, Ont., in 1929. He was division master mechanic at Regina, Sask., and Saskatoon, before his appointment as division master mechanic at Kenora, Ont., in 1950.

J. J. Raby

R. KLING, master mechanic of the Missouri Pacific at Nevada, Mo., now has jurisdiction over the Eastern, Joplin and White River divisions of the road.

VERNON L. MARLO, superintendent of shops of the Atchison, Topeka & Santa Fe at Barstow, Calif., has been appointed master mechanic at Argentine, Kan.

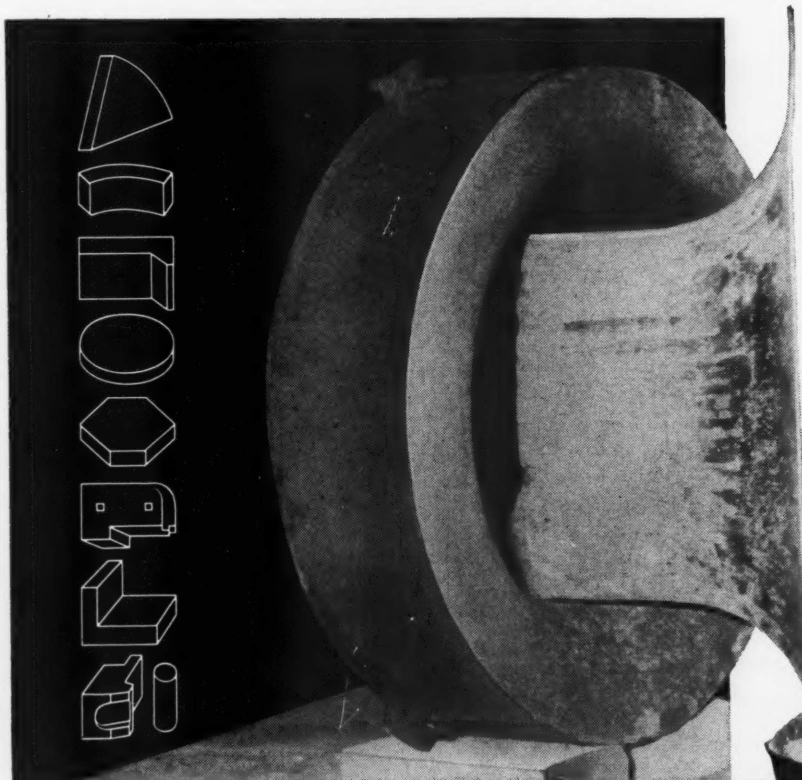
W. G. RINGLAND, assistant superintendent equipment, Buffalo and East, of the New York Central at New York, has been appointed master mechanic at Avis, Pa.

F. E. EDWARDS, superintendent electric equipment, Buffalo and East, of the New York Central, has been appointed master mechanic, with headquarters as before at Harmon, N. Y.

R. W. BALLARD, diesel supervisor—system of the Illinois Central, has been appointed master mechanic at Jackson, Tenn.

THOMAS MURRAY, master mechanic of the St. Louis-San Francisco at Tulsa, Okla., has been appointed master mechanic for

NOW... Get refractory shapes like this faster, at lower cost...



Photograph at left shows a boiler ring cast with 3X Firecrete. It is just one of many shapes that can be cast and fired in less than 24 hours with this hydraulic setting Johns-Manville refractory material.

Just mix, then cast. 3X Firecrete mixes and pours like concrete . . . is easy to handle.

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WITHIN 24 hours you can have ready for use any refractory shape you need—and save money as well—by casting it yourself with monolithic, hydraulic setting Johns-Manville 3X Firecrete*.

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93 YEARS OF SERVICE TO TRANSPORTATION

Southwestern and Western divisions, with headquarters at Tulsa.

U. F. Tihen, master mechanic of the Missouri Pacific at St. Louis, now has jurisdiction over the St. Louis Terminal division (west side of river).

Harold Mackey, master mechanic of the Atchison, Topeka & Santa Fe at Argentine, Kan., has been appointed master mechanic at Chicago.

J. C. Dietrich, master mechanic of the Missouri Pacific at Coffeeville, Kan., now has jurisdiction over the Southern, Kansas, Central and Wichita divisions.

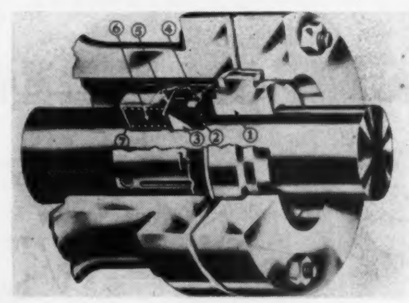
George M. Jessee, general foreman of the west locomotive shops of the St. Louis-San Francisco at Springfield, Mo., has been appointed master mechanic at Tulsa, Okla.

R. H. Seamon has been appointed assistant master mechanic, in charge of the west locomotive shop of the St. Louis-San Francisco at Springfield, Mo.

O. G. Sumner has been appointed road foreman of engines, mechanical department, of the Norfolk Southern, with headquarters in Raleigh, N. C.

NEW DEVICES

(Continued from page 136)



High Temperature Mechanical Seal

A new seal, designated as the type 9 Mechanical Shaft Seal, performs effectively under severe temperature and corrosive conditions.

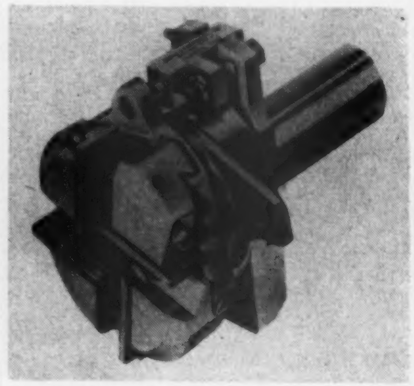
This seal incorporates a flexible ring molded from the new plastic, Teflon. The "wedge-ring" enables this seal to combine the chemically-inert properties of Teflon with the flexibility and positive sealing components essential to effective mechanical sealing. It can be employed at temperature up to 500 deg. F. and was developed by the Crane Packing Co., Chicago 13.

The seal has been designed for service on various rotating shaft applications, such as centrifugal pumps, turbines, positive displacement pumps and agitators.

Construction of the seal is shown in the illustration: The set-screwed metal re-

tainer (7) provides a drive from shaft to carbon sealing washer (2) through dents (4) which fit into washer notches. An effective seal between the shaft and washer is insured by the Teflon wedge ring (3) which is pre-loaded by the action of multiple springs (6). Spring pressure is distributed by a metal disc (5). The lapped raised face of the rotating sealing washer (2) mates against the lapped face of the stationary seat (1) to provide a leakproof seal with minimum running friction between the vertical faces.

◆



Die Heads

A line of die heads with ground thread tangent and radial chasers for high production class III threading with Brown & Sharpe automatics and small turret lathes has been announced by the Die Head Division, Jones & Lamson Machine Co., Springfield, Vt.

These chasers, ground all over, incorporate the exact helix angle and thread form. They are easily removed and replaced without disturbing the head and holder assembly.

Available in various models, the devices cover the complete B & S range from No. 0 to 1¼ maximum. Also, they are so arranged so that a single given die size will cover the capacity of a given B & S machine size.

Features include both radial and tangent chasers mounted on the face of the die for free coolant flow and good chip clearance; special Dualife insert chasers for No. 00 machine dies, allowing turning over and using on the other side; two-thirds of this line, using tangent chasers, provides permanent throat feature; precision lapped and fit chaser holding blocks; and lever handle for use on small turret lathes.

◆

Phosphorescent Indicator Signs

Those responsible for the safety of employees consider the consequences of a power failure in a night-time emergency. Shelter and direction indicators must be seen in darkness as well as in light to insure safety.

Phosphor-Lite, a product development

of Norco Products Mfg. Co., New York 14, is a plastic that is coated with luminous materials that glow in the dark. It is rigid, non-inflammable, fire retarding and will not warp or curl. Backed with adhesive, they will adhere to almost any surface.

The device cannot be seen from the air, but is visible 15-20 ft. by the pedestrian public. It will glow for approximately 8-10 hr. after the activating light has been extinguished. Should the emergency arise where power is disrupted, the block letters of the sign will direct the way.

Hydraulic Machinists' Vise

A new 4-in. jaw fast-operating hydraulic machinists' vise, known as No. 1004, is announced by the Columbian Vise & Mfg. Co., Cleveland.

This vise, which replaces the previous 3½-in. model, is substantially heavier (weighs 80 lb.) than previous models and has higher and wider jaws.

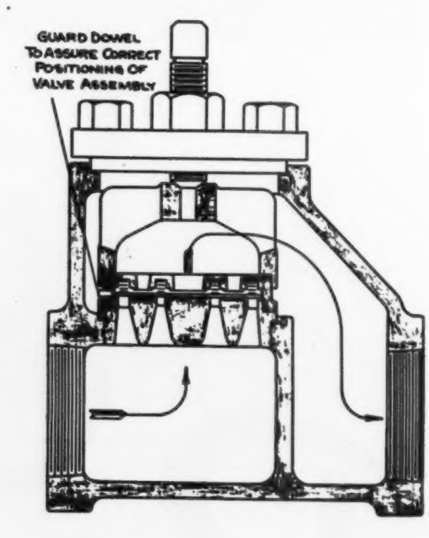
Maximum hydraulic pressure is 7,000 p.s.i. and maximum jaw pressure is 4,000 lb. A safety valve protects against overloading, and the jaws can be closed without damaging the lightest castings or finished surfaces. Vise closing speed is ⅞ in. per pump stroke. Full vise opening can be accomplished in 3 sec.

The hydraulic vise permits operators to use both hands to handle and position materials and in finishing work. The vise is controlled by two simple foot pedals—one for power, the other for release. Stop control is adjustable so that any production work is gripped and held with a single power stroke.

Transformer Welder

Air Reduction Sales Company, New York, has announced a new 200-amp. transformer welder. Designated as Model MCM 200, the welder is designed for general maintenance and production welding. It has a full 200-amp., 50 per cent duty cycle, N.E.M.A. rating, and is available for 220/440/550-volt operation, with or without power factor correction.

Two open-circuit voltages are provided, —80 volts on the low range and 55 volts on the high range. This combines easy arc starting with a lower kva. demand load and primary ampere current. An easy-to-read current indicator affords quick adjustment of welding current. There are no moving parts.

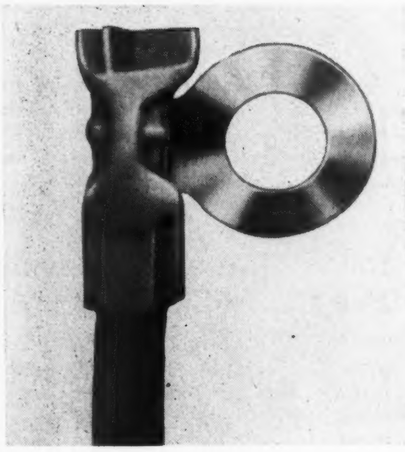


Discharge Line Compressor Valve

The function of a check valve in the discharge line of an air or gas compressor is to prevent leakage through the compressor during off cycle; to dampen pipe line pulsations; and to permit repairs to any unit where one or more than one compressor is on the line, without shutting down the entire system.

The PPC Aircheck Valve, introduced by the Pennsylvania Pump and Compressor Co., Easton, Pa. was designed to prevent compressor damage by safeguarding against forgetfulness of operating personnel to open a valve when starting up.

Installation of the device on discharge lines, according to the manufacturer, dispenses with customary arrangement of stop, safety and globe valves; prevents leakage of pressure through compressor during its off cycle and permits repairs without shutting down the system when more than one compressor is on the line.



Solderless Flag Terminal

A flag type solderless terminal equipped with body insulation is now being made by Aircraft-Marine Products, Harrisburg, Pa. The terminal can be installed with one stroke of a tool on standard wires in ranges from No. 22 to No. 10. A color-coded plastic sleeve of high dielectric qualities is bonded to a thin copper sleeve which is attached to the terminal barrel. The bombtail end is formed under optimum temperatures and pressures to make an intimate seal. The terminal is crimped to the wire by placing it end-on in a special tool so that the entire body is confined during the crimping cycle, and therefore the plastic sheath does not wrinkle or warp away from the terminal tongue.

Pre-insulated flag terminals can be used to advantage wherever space is at a minimum, or where a flag terminal is customarily used with separate tape or insulation tubing.

◆

Self-Emulsifying Cleaning Solvent

A solvent named Gunk and possessing high grease cleaning and carbon removing properties for the purpose of cleaning carburetors, fuel pumps, diesel injectors, pistons, oil strainers and metal parts has been introduced by the Curran Ordnance Chemical Laboratory. Lawrence, Mass. The product is described as a di-phase solvent and comprises a water emulsion floating top layer sealing a volatile chloraromatic solvent lower layer.

Performance of this di-phase solvent is substantially faster and will produce more complete and quicker results than can be obtained from present chlorinated type vapor degreasing solvents. Where chlorinated solvents can no longer be obtained because of critical shortages, this solvent may be used as a replacement in the present solvent distilling cleaning tanks.

Its top water-emulsion seal prevents direct contact with skin, such as dipping the hands or splashing the active lower layer solvent directly into the eyes. The solvent is also said to be fireproofed by reason for its top water emulsion seal. In addition, both phases are completely water soluble and in event of a sprinkler protected building, the solvent will simply rinse away as a solution of liquid.

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Anchorlite

An overhead suspension, interior illuminator for installation on loading platforms for loading freight cars, trucks or trailers, called Anchorlite, has been developed by the Pyle-National Company, 1334 N. Kostner avenue, Chicago. The light is designed to fill the need for a convenient, economical source of the good lighting required, temporarily, inside freight cars, trucks and trailers while at loading platforms. It is also for use in lighting the underside of equipment in locomotive and car shops, and in warehouses and stock rooms for lower bin lighting.

When installed as shown, it is always available for immediate use, yet overhead and out of the way. No time is lost finding extension cords and plug-in outlets, untangling cords, or finding or improvising support for hand lamps. Also, it avoids portable light cord damage from constant handling, dragging, and kinking, minimizes lamp breakage and eliminates theft of portable cords. It is grounded to its support, reducing shock hazards and short circuits. There are no cords to trip over.

The Anchorlite is designed to swing free on a swivel when suspended on a stationary bracket at a truck or trailer loading dock. A spring-loaded telescopic anchoring device provides up to three feet of expansion in length, with a firm supporting tension. The lightweight anchoring arm is easily pulled downward with a cord or hook and placed in the top of the car doorway, where it will support itself and not interfere with loading operations.

In a freight house installation, the Anchorlite is designed to be suspended from a messenger wire on which it can slide the full length of a loading platform bay, to any position where the freight car door may be spotted on the track.

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Battery-Powered Dispense For Heavy Lubricants

The Brown Dynalube Manufacturing Company, Charlotte, N. C., has developed a portable, battery-powered dispenser for the heavy, tar-like lubricants used in the traction-drive gear cases of diesel-electric locomotives. In most shops these lubricants have been handled entirely by hand.

The dispenser, called Dynalubricator GHM-3, has a capacity of 150 lb. of lubricant. The lubricant container, lubricant hose compartment and the pump are surrounded by a Fiberglas insulated water jacket. Two 220-volt, single-phase a.c. 1,000-watt, immersion type, thermostatically controlled heating units heat the lubricant to a working temperature, usually 160 to 170 deg. F., before the lubricant is pumped into the gear cases. Once up to heat, the lubricant will remain at a working temperature for about 8 hr. or more.

A metering lube gage built into the Dynalubricator accurately measures the lubricant pumped in each operation so that any amount up to 12 lb. can be pumped into each gear case. The amount to be pumped can be adjusted in a few minutes, with only a pair of pliers. This makes possible putting exactly the same amount of lubricant into each gear case. Two pounds of lubricant is pumped in 11 sec.; four pounds, in 22 sec., etc.

The lubricant hose is 15 ft. long and is fitted with a drip-proof nozzle. The pump will not run until the lube gage has been reset and the nozzle is fully opened. A safety switch on the hand control automatically starts the pump when the nozzle is opened. The lube gage cuts the motor off when the set amount has been pumped.

The Dynalubricator is mounted on rubber tires and is easily moved about and operated by one man.

The unit's drop cord is plugged into a 220-volt, single-phase a.c. outlet during the lubricant heating period but this line is disconnected before the pump is started. The pump is powered by a 19 plate, 6 volt storage battery. A self-contained battery charger recharges the battery during the heating period. The battery has sufficient power to pump more than 300 lb. of lubricant. Battery power gives the Dynalubricator complete freedom from power outlets and dangerous voltages during operation.

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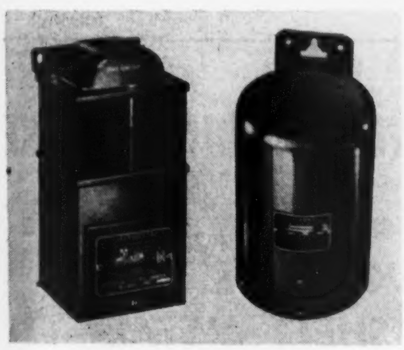

Transformers for Mercury Vapor Lamps

A revised line of transformers for operation of mercury vapor (H-1) lamps is announced by the Jefferson Electric Company, Bellwood, Ill. These include indoor and outdoor types. The line of indoor transformers consists of single and two-lamp units,—normal and high power factor,—available for 115- and 230-volt circuits, equipped with roomy wiring compartments having ½-in. and ¾-in. knockouts. Several primary voltage taps are provided to permit close matching of the transformer to the line voltage. The line of outdoor transformers lists aerial, pole top, pole base and vault types for building exterior lighting and parking and shipping area illumination. The transformers are designed and manufactured to meet the specifications of the leading manufacturers of mercury vapor lamps. The accompanying illustrations show a representative indoor and outdoor transformer.